

2.2003

(37)

aerospace technologies review **AIR FLEET**

RUSSIAN AND UKRAINIAN AIRCRAFT IN LATIN AMERICA

- Russian Air Force assessing the year 2002
- Russia, where heavy helicopters come from

ISSN 1561-8250
37
9 771561 825036

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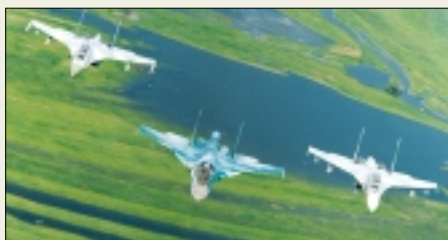
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(37)

AIR FLEET

aerospace technologies review

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Circulation: 10,000

Photos in this issue: H.J. van Broekhuizen, Piotr Butowski, Juan Carlos Cicales, Victor Drushlyakov, Andrei Fomin, Nikolay Laskov, Oleg Litvinov, Vyacheslav Martynyuk, Lewis Mehia Prada, Alexei Mikheyev, Alexei Pakhar, Paolo Poggi, Santiago Rivas, Sergei Sergeyev, Valery Solomakhin, Katsuhiko Tokunaga, Aleksei Tsaplin, Javier Goto Watanabe, Roger Westerhuis, Andrei Yurgenson, Andrey Zinchuk, design bureaux and production companies

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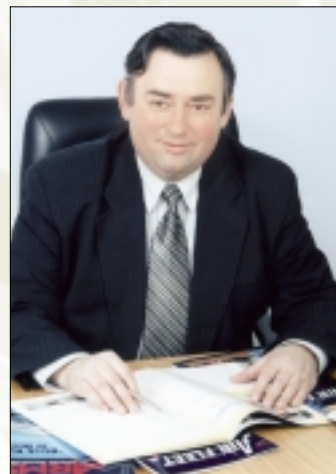
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The war in Iraq once again gave an undisputable evidence that the air power combined with supremacy in advanced technology provide nations which possess them effective means to prevail in modern combat conflicts. On the other hand, even if armed with outdated and obsolete weaponry, a well-motivated nation could provide significant resistance to an overwhelmingly more powerful invader, and technology alone cannot win a war.



Nevertheless, you cannot oppose even machine guns, let alone other sophisticated inventions of humans to kill other humans just with spears, arrows and bows, so a nation committed to its independence and sovereignty has to spend certain amount of its resources to maintain a technological level which would make a potential invader think twice before violating that nation's borders.

And though, as it appears, the mankind will have to live for at least several decades in an almost monopolar world with the sole superpower able to undertake unilateral actions without showing much concern about condemnation and protests from around the globe, an important thing to remember is that there are multiple sources of modern and capable weapon systems and aircraft technology, and not all of them are controlled by the all-mighty sheriff of Texas and the Universe.

However, really very substantial resources are needed to proceed further in development of advanced next-generation combat aircraft, and several nations which need an independent non-US source of combat aircraft for their Air Forces in 20 or 30 years from now cannot achieve this goal if they do not unite their efforts in a multi-national program very comparable and competitive to the USAF JSF. The four nations coming to one's mind under these circumstances are China, France, India and Russia. This combination may look strange at a first glance, but such are realities of today's international politics. Our magazine will cover all the aspects of possible Russian contribution to advanced combat aircraft development as well as all details of international co-operation in this area, which, hopefully, will develop in the nearest future. If not on a multi-national level, than as a series of bi-lateral agreements. We met you in Bangalore, next stop is Paris.

Alexander Velovich

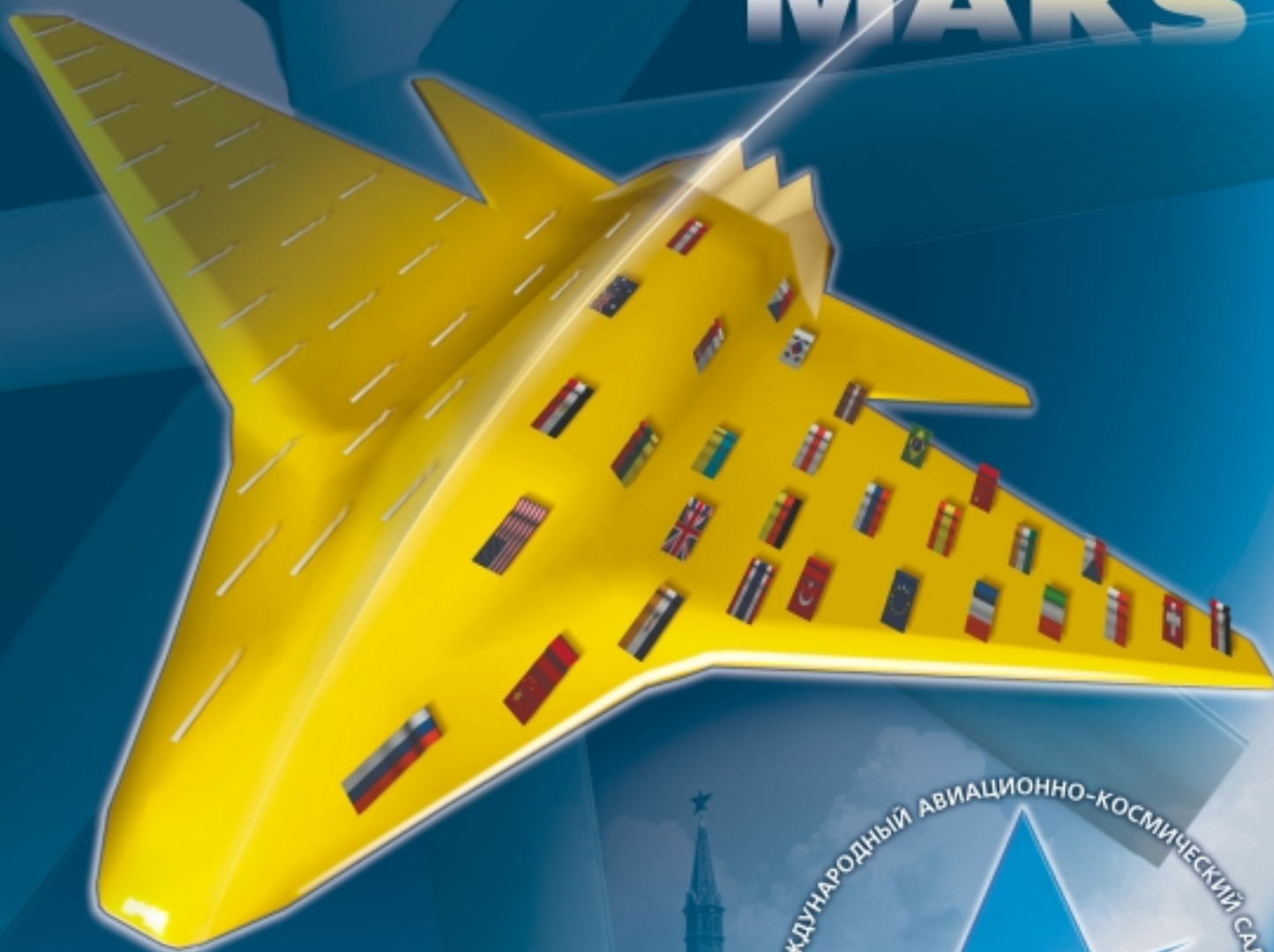
Intervestnik Publishing House
Editor-in-Chief

August 19-24, Moscow-Airport Zhukovsky

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Military aviation

Russian Knights and new Swifts in one formation

On 22 March during the celebration of the 65th anniversary of the 237th Aircraft Demonstration Centre of the Russian Air Force (TsPAT), deployed at the Kubinka airfield outside Moscow, spectators saw for the first time demonstration flights of the Russian Knights and the Swifts aerobatics teams, assigned to the Centre, flying in a common formation of ten aircraft (four Su-27s and six MiG-29s).

In 2002 and early 2003 the 237th TsPAT managed to train new pilots for team aerobatics, which enabled the Centre to tailor the Russian Knights' aerobatics diamond (a team of four), and basically revive the Swifts aerobatics team, comprising six aircraft, after a long break. In addition to that in February-March 2003 Swifts were equipped with upgraded MiG-29s, sporting new bright paint coats. Russian Aircraft Corporation MiG, in particular its Lkhovitsy-based aircraft plant, greatly assisted the afore-mentioned aerobatics team in the whole affair by refining and painting the aircraft handed over.

At the moment the Swifts aerobatics team operates six aircraft with new paint coats: two MiG-29UBs (registration numbers 01 and 02) and four type 9-13 MiG-29s (registration numbers 03-06). All aircraft mentioned above participated in demonstration flights on 22 March. The rest of MiG-29s (type 9-12), sporting the former Swifts paint coat, will remain in service with the 2nd Squadron of the 237th TsPAT until their service life expires.

The Russian Knights' diamond currently operates two Su-27 single-seaters and two two-seat Su-27UBs. In the future the aerobatics team may receive Su-35s (Su-27Ms). At the present time the team comprises the following pilots: Colonel Igor Tkachenko (leader),



Lieutenant Colonels Igor Shpak (portside wingman), Oleg Ryapolov (starboard wingman), and Dmitry Khachkovsky (tail wingman). Lieutenant Colonels Ryapolov and Shpak underwent the diamond aerobatics training programme last year, and on 2 August 2002 Russian Knights carried out their maiden flight in the new composition. In addition to diamond aerobatics, the team's demonstration programme also includes stunts in pairs and collision-course aerobatics, carried out by I.Tkachenko and D.Khachkovsky, as well as Igor Tkachenko's solo flights.

The Swifts aerobatics team incorporates Colonels Nikolay Dyatel (team leader), Gennady Avramenko (portside wingman), Lieutenant Colonels Mikhail Loginov (starboard wingman), Viktor Selyutin (tail wingman), Vadim Shmigelsky (outermost portside wingman), and Igor Sokolov (outermost starboard

wingman). The team has had this composition since 4 March 2003. Team leader N.Dyatel, as well as outermost portside wingman V.Shmigelsky also carry out solo flights.

The Russian Knights and the Swifts aerobatics teams are the most combat ready units in the Russian Air Force. For instance, three out of six Swifts pilots are qualified sniper pilots with a total flying time of over 1,300 hours, while another two are first-class combat pilots. The average flying time of the six-man strong team, divided into six, equals in excess of 1,100 hours. The average age of Swifts pilots is 37 years. Another two pilots (second-class combat pilots Lieutenant Colonel Dmitry Koposov and Major Valery Morozov) are undergoing the Swifts aerobatics training programme. In addition to that the team is also manned with another five young pilots. Majors Oleg Yerofeyev and Andrey Alekseyev are expected to join the six-aircraft formation of the Russian Knights aerobatics team in the near future.

The aerobatics training programme is carried out in the 3rd Squadron of the 237th TsPAT, which has recently been fielded with MiG-29 fighters instead of L-39 trainers.

The first joint training flights of Russian Knights and Swifts in a single formation of ten aircraft were carried out on 19 March this year. It was the first joint flight of the two aerobatics teams since they were established in 1991. Three days later the Kubinka airfield's pilots were capable of demonstrating their skills to military commanders, personnel, and visitors of the 237th TsPAT, which testifies to their outstanding piloting techniques and reliability of their aircraft.



Long-range aviation exercises

Mid February saw training exercises of the 37th Air Army of the Supreme Strategic Command, the only national long-range aviation unit. On 12 February Tu-22M3 aircraft in service with the heavy bomber regiment, deployed at the Soltsy airbase outside Nizhny Novgorod, delivered bomb strikes against dummy targets at the Guryanovo firing range outside Saratov. On 13 February Tu-22M3s, deployed at the Shaikovka airbase outside Smolensk, once again attacked dummy targets. Some aircraft dropped FAB-250 air bombs, while two crews launched Kh-15 tactical missiles against targets, set up at an Air Force firing range in Kazakhstan, leased to Russia. All targets were successfully engaged.

Besides heavy bombers the exercise also saw participation of MiG-31 interceptors, deployed at

the Khotilovo airfield outside Tver, which escorted long-range bombers, the An-12PPS ECM aircraft, deployed at an airbase in Orenburg, and the air defence unit, deployed in a town of Engels outside Saratov and equipped with S-300PM SAM systems. The A-50 AWACS aircraft from the Ivanovo airbase also participated in the exercise by provid-

ing air surveillance and guiding fighters.

The long-range aviation exercise was the pinnacle of the routine inspection of the 37th Air Army. In the course of the inspection, the Military Inspection Committee, headed by Lieutenant General Aleksandr Lukin, examined activities and combat readiness rates of

the Army's commanders and the Donbas Guard Heavy Bomber Air Division, deployed at the Engels airbase outside Saratov. In particular, inspectors examined Tu-160 and Tu-95MS aircraft, currently in the inventory of the Russian long-range aviation, and their armament, as well as the Tu-134UBL combat trainer.



Industry

Russian aircraft industry in 2002

On 14 February the Rosaviakosmos board summed up what had been achieved by the Russian aircraft industry in 2002, and defined goals and objectives for 2003. Valery Voskoboynikov, Rosaviakosmos (Russian Aviation and Space Agency) Deputy Director General, addressed the board, stating that, according to preliminary estimates, Russia had manufactured about 120 aircraft of all types in 2002.

The aircraft in question comprise 60 civilian aircraft (15 fixed-wing and 45 rotary-wing ones), including two Tu-214s, two Tu-204s, one Tu-154M, one An-74, three An-38s, five An-3s, and one M-101T Gzhel. Out of all aircraft produced only four aircraft (two

Tu-214s, a Tu-204, and a Tu-154M) and five helicopters were procured by national companies, while the rest of them were exported.

The Russian aircraft industry increased its total output by 24.9 per cent last year as compared to 2001. Last year the total number of employees in the aircraft industry increased by almost 3,500 to about 500,000 people. The average salary in the industry increased by 38 per cent in 2002.

The year of 2002 saw such pivotal events as certification of the An-38-200, M-101T Gzhel, and Yak-54 aircraft, as well as TVD-1500, TVD-20 engines, and the TA-18-100 auxiliary power unit (APU), designed to be fitted on airliners. In addition to that the

Tu-334 aircraft progressed through cornerstone stages of certification tests, and on 30 December 2002 a decision was taken to launch its mass production. The flight and certification tests of the following fixed- and rotary-wing aircraft were underway in 2002: the Be-200 amphibian, the Tu-204-120 medium-haul passenger airliner, fitted with foreign power plants and avionics (to meet West European JAR requirements), the upgraded Il-76MF transport, powered by PS-90A-76 engines, the Ka-226 light utility helicopter, and the Mi-171 and Mi-172 medium utility helicopters, fitted with new main rotors.

In 2002 engineering documentation and production forms and

records for the Tu-204-300 passenger airliner were released, production of the first Mi-38 medium utility helicopter prototype drew to an end, while development of the Ka-62 medium utility helicopter prototype continued.

Touching upon the overall output of the Russian aircraft industry in the past few years, Mr. Voskoboynikov stressed that quite a stable growth trend had been true since the all-time low in 1997 (only 16 per cent as compared to that of 1988, which is regarded as the standard). In 1999 this figure equalled 23.2 per cent, in 2000 almost 33 per cent, in 2001 - 37 per cent, while in 2002 it totalled 48 per cent as compared to that of 1988.

Tu-334 to start passenger traffic next year

The second prototype of the new Tu-334 short-haul airliner (No 94005) is expected to be assembled by the Kiev Aviant plant this June. The third prototype (No 94003), being built by the Lukhovitsy-based plant of the Russian Aircraft Corporation MiG outside Moscow, is to join tests in autumn 2003. Under the decree of the Russian government dated 31 October 2002, Tu-334 tests are to be completed and the aircraft is to be certified in December 2003, after which the aircraft can embark on transporting passengers.

By early 2003 the first prototype (No 94001) had progressed through the toughest stages of certification tests, namely test flights aimed at assessing the aircraft's stability and controllability at great angles of incidence. In addition to the first three prototypes the certification tests will also see participation of two airframes, designed for ground tests: No 002 (for static tests) and No 004 (for service life tests).

The following four aircraft plants participate in the joint Tu-334 series production programme: the Lukhovitsy Aircraft Production and Test Centre (LAPIK) of the MiG corporation, the Kiev Aviant aircraft

plant, Taganrog-based Tavia JSC, and Ulyanovsk Aviastar-SP JSC. The final assembly of the aircraft in question will be carried out in Lukhovitsy and Kiev. Aviastar-SP is responsible for manufacturing the nose fuselage, Aviant – the wing and mid fuselage, Tavia – the rear fuselage and tail unit, and RAC MiG – engine nacelles. D-436T1 engines to be mounted on Tu-334 aircraft are to be produced jointly by the Zaporozhye-based Motor Sich JSC, Ukraine, the Moscow Salyut MMPP enterprise, and UMPO JSC in Ufa.

The first series production Tu-334s are to be delivered in 2004. The Aviant plant started manufacturing the first batch of five Tu-334s in late 2002. In compliance with a governmental decree RAC MiG is to deliver the first four mass-produced aircraft in 2004 (Nos 2101-2104). Igor Shevchuk, President of Tupolev JSC, designer of the aircraft, believes that the demand for Tu-334s in the CIS market is assessed at 170 aircraft.



New "Air One"



The Voronezh Aircraft Joint-Stock Company (VASO) is completing the new presidential Il-96-300PU aircraft. The aircraft in question (the tenth Il-96-type aircraft) was launched into production as one of the three presidential Il-96-300s in Voronezh in 1992. However, in the mid-1990s only one aircraft (registration No RA-96012) was manufactured and handed over to the Rossiya State Transportation Company. It was employed to provide transportation to the first Russian President Boris Yeltsin. At the moment it serves President Putin.

Production of the second "Air One" was resumed only in November 2001. The flight tests of the aircraft started this May. After the tests the new

Il-96-300PU will be handed over to Rossiya and will become the major aircraft of the Russian president, deployed at the Moscow Vnukovo-2 airport. The first Il-96-300PU, which is currently "Air One", will be used as a standby aircraft (at the moment an Il-62M is on standby).

Just like other Il-96-300 aircraft, "Air One" will be powered by the Russian PS-90A engines. As compared to the mass-produced Il-96-300s, its main features will include special layout and finish of the passenger cabin, and special communications means. With this aircraft President Putin will be able to carry out non-stop flights to any corner of the world (the aircraft's maximum range totals up to 12,000 km).

Second wind of famous Mi-8

The Mil Moscow Helicopter Plant has built the full-size mock-up of the Mi-8GM upgraded helicopter (GM stands for deep modernisation). The Mi-8GM features the same size as the mass-produced Mi-8MTV (Mi-17), but is fitted with a number of totally new units and systems. For instance, it mounts a new rotor system, an upgraded power plant, an X-shaped tail rotor, and upgraded avionics suite. New design features and state-of-the-art avionics will improve almost all major characteristics, thus, enabling the Mi-8GM to remain in service for at least another 25-30 years.

IL-76 production to be transferred to Voronezh

As early as next year production of upgraded Il-76MF military transports, powered by PS-90A-76 engines and boasting a greater lifting capacity of 52t, may be transferred to the Voronezh Aircraft Joint-Stock Company (VASO) at the request of the Russian Air Force. At the present time Il-76MDs are produced by the Tashkent Aircraft Production Corporation (TAPC) in Uzbekistan, which makes the Russian Air Force Command uneasy. The first Il-76MF aircraft was also built in Tashkent in 1995, after which the initial batch was launched into production.

The decision to transfer the Il-76MF series production to Voronezh was taken jointly by Rosaviakosmos, the Russian MoD, and the Russian Ministry of Industry, Science, and Technology. However, the project requires substantial funds, which will determine the schedule of launching new aircraft into production at VASO. At the same time the Voronezh-based plant is participating in the programme, envisaging retrofitting mass-produced Il-76MDs with new PS-90A-76 power plants, substituted for the previous D-30KP engines.

Sukhoi RRJ wins future regional aircraft bid

In March Rosaviakosmos drew the results of the bid to develop the future regional passenger aircraft, which will replace obsolete Tu-134 and An-24 airliners on Russian internal flights. The RRJ (Russian Regional Jet) project, introduced by Sukhoi Civil Aircraft JSC (affiliate office of the Sukhoi company), won the bid in three categories: a 60-, a 75-, and a 95-seat airliner. RRJ's rivals included the Tu-414, developed by Tupolev, and M-60-70, designed by the Myasishchev Design Bureau.

The tender committee singled out the RRJ project as the one, developed most thoroughly.

The US Boeing's having a hand in the RRJ project also played a pivotal part in tipping the balance in favour of Sukhoi Civil Aircraft, which secured a contract on cooperation with Boeing in 2001. Besides Boeing, the RRJ programme also enjoys participation of the Ilyushin Aviation Complex and the Yakovlev Design Bureau, however the Sukhoi Civil Aircraft Corporation, which will carry out 80 per cent of the development effort, remains the flagship company in the project. Almost a quarter of all funds for the project (development, prototype production, certifica-



tion tests, and series production) will be earmarked from the national budget, with Boeing also providing a considerable shot in the arm. The new regional airliner is expected to make its appearance in the aircraft market in 2007. It is supposed to be produced by Sukhoi's aircraft plants in Novosibirsk and Komsomolsk-on-Amur.

First Russo-Indian transport to be developed in six years



The first prototype of the Russo-Indian MTA multi-purpose transport aircraft is to be submitted for flight tests in 2009, according to the project parties - the Irkut Corporation and the Ilyushin Aviation Complex from the Russian side, and the HAL Corporation from the Indian side. The transport jet with a lifting capacity of 20t will be based on the Russian Il-214 aircraft and is designed to replace An-32s in service with the Indian Air Force, and An-12s and An-26s in the inventory of the Russian Air Force. The Indian Air Force is planning to procure 45 MTA aircraft, while the needs of the Russian Air Force in aircraft of this type are estimated at about a hundred.

Su-38L to be certified by year end

Certification tests of the new Su-38L crop-spraying aircraft are expected to be completed in July-August 2003, while in September-October this year it may be awarded the certificate and launched into mass production.

However, it hasn't been decided so far what plant will produce Su-38L aircraft. The Smolensk aircraft plant has had a hand in the programme by delivering units for assembling the initial batch. At the present time the plant has delivered complete sets of units for all five prototypes to the Sukhoi Design Bureau.

The cost of the aircraft, including the manufacturing cost and the market price, will be the primary factor in selecting the Su-38L manufacturer.

According to preliminary estimates, Su-38L is expected to cost \$150,000-200,000. The Komsomolsk-on-Amur Aircraft Production Association, which already produces Sukhoi Su-80 civil aircraft and is getting ready for manufacturing the RRJ future regional aircraft, is considered to be one of the options for launching Su-38L into series production.



Mi-38 to make maiden flight this summer

The future Mi-38 medium utility helicopter is to make its maiden flight at the Kazan Helicopters facilities in summer 2003. Shifting the schedule of the first flight, which was to have been carried out in January 2003, was caused by extensive ground tests of the helicopter prototype, featuring brand new airframe design, power plant, and avionics suite.

According to Yuri Andrianov, Director General of the Mil Moscow Helicopter Plant, designer of the new rotary-wing aircraft, the Mi-38 was intended, first and foremost, for the international market. The expected cost equals around \$11 million, which is quite expensive for national air carriers. The helicopter can only secure its niche in the

domestic aircraft market if its cost is cut back.

The Mi-38 is capable of airlifting up to 30 passengers or five tonnes of cargo (or up to seven tonnes of cargo if mounted externally) at a cruising speed of 275km/h at a range of up to 820km (up to 1,350km when fitted with extra fuel tanks).

PS-90A today, PS-90A2 tomorrow

In 2002 the Perm engine plant manufactured five new generation PS-90A turbofans (four of them for Russia's new Il-96-300PU aircraft and the fifth one for tests). This is the first time the plant has had an output like that in the past four years. At the present time the Perm engine plant boasts a portfolio for producing nine new PS-90A engines for Il-96, Tu-204, and Tu-214 aircraft, being built by the Voronezh-, Ulyanovsk-, and Kazan-based aircraft plants.

Aleksandr Inozemtsev, Designer General of Perm-based Aviadvigatel JSC, PS-90A designer, was quoted as saying that the engine in question was operated intensively, while its characteristics were comparable to those of its foreign counterparts. A PS-90A engine costs just over \$2 million, while similar foreign engines cost about \$6 million. Thus, Russia enjoys a two-fold-plus lead with respect to prices, despite mushrooming internal prices for metal and spare parts.

Aviadvigatel slated bench tests of the new PS-90A2 power plant for summer 2003. The afore-mentioned power plant, an upgraded derivative of the PS-90A engine, features a 40 per cent longer service life. At the present time



the company is manufacturing the first two prototypes of the new power plant. PS-90A2 certification tests are slated for 2004.

Potential customers, including the Ilyushin Finance leasing company, have already expressed their

desire to procure up to 300 PS-90A2 engines. The new power plant is expected to be mounted on the same aircraft as the PS-90A, namely Il-96-300s, Tu-204s, Tu-214s, and their modifications.

NK-93 tests

Kazan Motor-Building Production Association JSC continues ground tests of the new powerful NK-93 propfan, designed by the Samara Scientific Industrial Complex named after N.D.Kuznetsov. It is also getting ready to start its flight tests in a flying laboratory. The power plant with a takeoff thrust of 18,000kgf is designed to be mounted on Tu-204, Tu-214, and Il-96 modifications, as well as the future Tu-330 military transport, and Tu-204-330 freighter. The NK-93 propfan is a unique combination of a super-high-bypass-ratio turbopan (in excess of 16) and a turboprop (propfan)

engine. The development of the engine in question, started in 1993, has recently intensified. The development is funded by Rosaviakosmos. Certification tests are expected to start this year simultaneously with flight tests.

NK-93 meets contemporary ICAO noise requirements and future emission standards, and it is superior to other similar engines of the

Another year of testing for upgraded Mi-24s



Joint official tests of the upgraded Mi-24VM helicopter, started in March 2002, are expected to be finished in the first quarter of 2004. Unlike the production Mi-24V in service with helicopter regiments of the Russian Air Force, the upgrade is equipped with a new rotor system and an X-shaped tail rotor, adopted from the new Mi-28N helicopter, as well as new avionics.

Last year besides Mi-24VM development, the Rostov-based Rostvertol helicopter plant also retrofitted two manoeuvre unit Mi-24Ps to Mi-24PN upgrades, capable of operating round the clock. This year the plant plans on retrofitting another four helicopters using the same technique. Mi-24VM and

Mi-24PN tests are carried out within the framework of the joint research and development programme, realised in compliance with the modular design modernisation of manoeuvre unit Mi-24s, proposed by the Mil Moscow Helicopter Plant.

Following the official tests, all design innovations, tested on several upgraded Mi-24s, are supposed to be integrated into a single helicopter, which will become the pattern aircraft for future modernisation of manoeuvre unit Mi-24Vs and Mi-24Ps in service with the Russian Air Force. Mi-35 and Mi-35P export versions, widely employed across the world, are expected to be upgraded in the same way.



same thrust as far as fuel consumption is concerned. Given the facts mentioned above, the propfan in question is considered to be one of the primary future national engines to be fitted on heavy passenger airliners, air freighters, and military transports. Its development is supported by the Russian MoD, Air Force, and naval aviation authorities.

Gzhel to become Sokol

The board of directors of the Nizhny Novgorod-based Sokol Aircraft Manufacturing Plant held its meeting in Moscow on 27 March 2003. Among the items on the agenda was choosing a new designation for the M-101T aircraft.

Sokol had started manufacturing the aircraft in question long

the board of directors ordered Sergei Nedoroslev to turn to the Myasishchev Design Bureau with the proposal that the M-101T Gzhel aircraft be re-designated M-101T Sokol.

In March 2003 the plant secured a contract for manufacturing eight aircraft by September



before the aircraft proper was certified. In the course of manufacturing the first prototype, experts of the Sokol Design Bureau contributed a considerable share to modifying the aircraft. That is why

2003. At present the plant is certifying the M-101T Sokol production and setting up a flight training centre to train pilots and maintenance crews to operate the new aircraft.

Sokol building Yak-130



The assembly of the first mass-produced Yak-130 is well under way at the Nizhny Novgorod-based aircraft plant. The aircraft is expected to be demonstrated at the Le Bourget air show in June 2003 and the MAKS 2003 air show in Zhukovsky. The flight tests are slated for this autumn.



Akkord to scan Moscow Region

Akkord is to make its appearance over the Moscow Region in the near future. The aircraft will be tasked with monitoring the region. With this end in view, a hatch for mounting special equipment has been cut out in the rear part of the cabin. The aircraft has been converted under the agreement with the Russian State Land Registry.

The aircraft has been designed by the Moscow-based Avia Ltd. Design Bureau and is being built by the Sokol Aircraft Manufacturing Plant in Nizhny Novgorod, which guarantees its high production quality.

In addition to the wheeled landing gear, the aircraft may also be fitted with retractable floats, which will enable it to expand the scope of tasks discharged.



Contracts

Sukhoi upgrades Polish Su-22s

In January 2003, two Polish Air Force repair plants, namely the Bydgoszcz-based WZL-2 aircraft repair plant and the Warsaw-based WZL-4 plant, secured contracts with the Russian Sukhoi company, envisaging repair works on and maintenance of Su-22 fighter-bombers in service with the Polish Air Force. Until that time, for the past decade Polish aircraft had been repaired by being fitted with spare parts, delivered primarily from Ukraine and Belarus in one way or another. The contracts secured envision for Sukhoi to hand over all production forms and records on Su-22 design modifications to the Poles, as well as have a hand in providing maintenance to the aircraft in question and extending their service life.

It is only recently that Sukhoi has been authorised by the Russian government to independently deliver spare parts to foreign customers and provide maintenance to its aircraft,

operating outside Russia. The contracts, signed with the Polish aircraft repair plants, are the first of the kind for the Sukhoi enterprise. At the same time Sukhoi is yet to be licensed to independently upgrade its aircraft in service with foreign countries, while at the present time

such projects can only be carried out under Rosoboronexport's auspices.

At present the Polish Air Force (Wojska Lotnicze) operates 98 Su-22 aircraft, including



80 Su-22M4 single-seat fighter-bombers and 18 Su-22UM3K two-seat combat trainers. At least 60 of them are to remain in the inventory of the Polish Air Force until 2010-2012.

New ILs for Atlant-Soyuz

The Atlant-Soyuz air carrier, one of the top five Russian freight carriers, and the Ilyushin Finance Co. leasing company (IFC) signed a contract in Moscow in mid-January on leasing two brand-new IL-96-400T wide-body long-haul transports. Thus, IFC started realising the framework agreement on delivering ten IL-96-400Ts to the afore-mentioned air carrier, signed at the MAKS 2001 air show in August 2001.

Basic specifications of the IL-96-400T transport are similar to those of the IL-96T aircraft, fitted with the US-produced power plant and avionics suite, which has been certified to FAA standards. Nevertheless, production of this aircraft has been scrapped because western banks have failed to grant

one billion dollars' worth of credits to the IL-96T project.

Valery Menitsky, chairman of the Atlant-Soyuz board of directors, was quoted as saying that IL-96-400T was the world's only aircraft capable of airlifting all types of containers including naval ones. IL-96-400T's cargo hold is 25 per cent larger than the passenger cabin of the IL-96-300 aircraft, upon which the stretched transport version has been based. The new transport aircraft will be capable of airlifting up to 92t of cargo in standard environment, and up to 72t when operating in hot weather and from a high-level home base.

IL-96-400T aircraft are to be powered by PS-90A engines compliant with ICAO Annex

16 Chapter 3 noise requirements that will remain effective until 2005. Starting from 2006, when ICAO Annex 16 Chapter 4 comes into force, aircraft in question are supposed to be fitted with the PS-90A engines, equipped with additional sound-damping panels, as well as PS-90A2 engines, upgraded jointly with Pratt & Whitney.

The first aircraft is expected to be delivered 18 months after financial assets are earmarked for completing it. The second IL-96-400T is supposed to follow the first one in three months. Given the fact that the first two aircraft have been under production for a long time, their cost is expected to be around \$30-40 million, while that of newly produced aircraft will total \$50-55 million.

New IL-96-300 for Aeroflot

In February IFC leasing company, the Ilyushin Aviation Complex, and the Voronezh Aircraft Joint-Stock Company (VASO) signed a contract on completing manufacture and delivering six IL-96-300 passenger airliners to Aeroflot. The total cost of the contract signed equals in excess of \$240 million.

IFC is to transfer the first IL-96-300 to Aeroflot within the next 18 months, while the remaining five aircraft are expected to be delivered at a two months' interval each. A total of eight nearly complete IL-96 airframes, incorporating six IL-96-300 passenger airliners for Aeroflot and two IL-96-400Ts for Atlant-Soyuz, are currently at the Voronezh aircraft plant.

First IL-76TF to be built by year end

The first IL-76TF transport will have been built by the Tashkent Aircraft Production Corporation by late 2003. The aircraft has been ordered by the Russian Volga-Dnepr air carrier.

IL-76TF is the civil version of the upgraded IL-76MF military transport. Unlike the baseline production IL-76MD, IL-76MF and IL-76TF feature a 6m longer fuselage, a larger cargo hold, and the new PS-90A-76 power plant. The lifting capacity of the new aircraft may total 60t.

IL-78s for India

The Tashkent Aircraft Production Corporation (TAPC) is to deliver six IL-78MK tankers to the Indian Air Force by late 2003. In late February the first IL-78MK aircraft was handed over to the customer at an official ceremony in Tashkent, attended by Indian Defence Minister George Fernandez.

The contract, envisaging production of six new IL-78MK tankers for a total cost of \$150 million, was awarded to the Tashkent manufacturer in late 2001. The first version of the IL-78 tanker, based on the IL-76MD military transport, was developed by the Ilyushin Design Bureau in 1983. It was intended for flight refu-

elling long-range and tactical aircraft. By 1991 the Tashkent-based plant had manufactured about 40 IL-78s and IL-78Ms, which are currently in the inventory of the Russian and the Ukrainian air forces. Production of the aircraft in question was suspended in 1993 due to lack of contracts and funding. Thus, the contract, awarded by India, allowed the tanker production to be resumed after almost a decade's break. Unlike the latest production IL-78Ms, aircraft to be delivered to India comprise the IL-78MK versatile modifications, which can be used both as tankers and military transports.

Yak-42D for Czech Republic

In early 2003 the Saratov-based aircraft plant is to deliver three Yak-42D short-haul airliners to the Czech Republic. The three aircraft are to be delivered under the intergovernmental agreement signed as far back as the mid-1990s.

The cost of the Yak-42D aircraft, being built in Saratov, equals about \$12 million. OAO Gazprom is one of the many customers, wishing to procure Yak-42D. Some time ago it ordered five different versions of Yak-42D, but it only managed to procure just one of them in 2001. At the present time the ongoing production of the four aircraft, ordered by Gazprom, is in fact suspended, as the company is unlikely to purchase them. The given aircraft will be awaiting their new owner.

Be-200 to be delivered this year



The first two of seven Be-200ChS amphibious jets, ordered by the Russian Ministry of Emergency, will have been built and delivered to the customer by the Irkut Scientific Industrial Association by the turn of 2003. This February the first production aircraft was progressing through the final assembly stage. In April it is to be submitted for factory tests, after which it will be handed over to the customer. The contract is expected to be fulfilled by 2005.

Simultaneously with initial production, the first Be-200ChS has been undergoing certification tests since the fourth quarter of 2002. About 60 flights had been carried out by early March. The certification tests are expected to be completed by the end of this year.

The Be-200, powered by the Rolls Royce engines, may become one of the export options. At the present time a special team, comprising experts from Irkut, EADS, and Rolls Royce, is working on certifying and promoting Be-200s in the international market. Be-200 costs up to \$20-25 million, depending on the modification.

Russian forestry aviation procures An-3Ts

On 27 January the Omsk-based Polyot industrial association handed over the first two An-3T-08 forest patrol versions to the Avialesookhrana (forest patrol aviation) department of the Russian Natural Resources Ministry. The aircraft were transferred in compliance with the forest patrol aviation development programme, adopted for 2002-2010, which envisions upgrading Avialesookhrana's aircraft fleet and fielding ten An-3T-08s annually.

In 2002 the association secured contracts for 19 An-3 aircraft, but only seven of

them were in fact manufactured (five An-3s were converted from An-2s and fitted with new power plants, while two An-3T transports were converted into passenger planes).

It costs about \$400,000-500,000 to convert an An-2 into an An-3. At the moment 15 An-3 aircraft have been delivered to customers, while the overall demand for the aircraft in question is estimated at one third of the total An-2 fleet, which comprises 500 to 600 aircraft in Russia alone.

Mi-34 in Kazakhstan, Nigeria, and Russia

In 2003 the Arsenyev-based Progress aircraft company is planning to deliver 10 to 15 various modifications of the Mi-34 light utility helicopter.

In early 2003 the first two patrol versions of the helicopter in question were shipped to Kazakhstan to be employed by local police. According to preliminary estimates, Kazakhstan is capable of procuring a total of ten Mi-34 helicopters.

So far the Progress company has manufactured and sold 21 Mi-34 helicopters, including export variants delivered to Nigeria. It has recently shipped the first batch of eight Mi-34S helicopters to the country. Nigeria recognizes the Russian Airworthiness Certificate awarded to the helicopter. At present negotiations on continuing exports are being held. Both sides have also arrived at a pivotal decision to establish a maintenance centre in Nigeria, along with a spare parts depot for supplying spare parts to Mi-34 helicopters already imported and those awaiting delivery.

In the coming two and a half years five Mi-34S light helicopters will also be fielded with the Omsk Civil Aviation Flight School.

The minimal cost of the helicopter totals \$400,000-420,000.



Flight Safety

2002 flight safety results in Russian military aviation

Flight safety results in the Russian Armed Forces aviation have been drawn for 2002. Last year air crashes and other accidents accounted for eight fixed-wing and 11 rotary-wing aircraft lost within the Russian MoD. The eight aircraft destroyed include three L-39s, one An-26, one An-12, one Su-24, and one Su-27, while the 11 helicopters comprise six Mi-8s, four Mi-24s, and one Mi-26. The so-called human factor allegedly caused 67 per cent of all crashes.

In 2002, 11 accidents, which resulted in losing one Su-25 aircraft and nine helicopters, occurred in the North Caucasian region (in one of the accidents the Mi-8 helicopter proper came out intact, but one passenger was killed). Nine crew members and 136 passengers were killed in the afore-mentioned accidents. Five helicopters (two Mi-8s, two Mi-24s, and one Mi-26) were shot down, with four of them falling victim to Strela shoulder-fired air defence systems, fired by Chechen terrorists.

The number of accidents in the Armed Forces aviation in 2002 decreased by 17 per cent as compared to that in 2001, but the amount of damage, caused by air crashes and other accidents, increased. The number of passengers and crew members killed in such accidents increased from 49 people in 2001 to 179 in 2002.

Another tragedy in Iranian mountains

On 19 February 2003, at about 18:00 hours Moscow time the Iranian Air Force Il-76 transport crashed in Iran during final approach in adverse weather conditions, when carrying out an internal flight from Zahedan to Kerman. The aircraft carried 276 passengers, including 258 soldiers of an elite Iranian unit of the Islamic Revolutionary Guards Corps. All those aboard were killed. At an altitude of about 3,500m above sea level the aircraft crashed into the slope of the Sirch hill, situated 35km south-east of the destination airfield. Pilots managed to warn ground air traffic controllers of zero-zero visibility and strong wind gusts, after which communications went down. The ensuing search and rescue operation, hindered by the alpine terrain and adverse weather conditions, lasted for seven days. Investigation is underway.

Experts consider the notorious human factor to be the most likely cause of the air crash - an error made by either the crew or air traffic controllers, when carrying out a low-level flight in alpine terrain in adverse weather conditions. Iranian authorities do not rule out the possibility of a terrorist attack.

Ilyushin IL-86s to keep on flying

Investigation of the crash of the Il-86, belonging to the Pulkovo air carrier, has drawn to an end. The crash occurred at the Moscow Sheremetyevo-1 airport on 28 July 2002 and resulted in killing 14 of out 16 crew members (the aircraft was

conducting a technical flight). The accident was caused by the spontaneous shift of the aircraft's stabiliser to its extreme position, which resulted in bringing the Il-86 to an angle of incidence beyond stalling and the subsequent crash. The Sheremetyevo crash has become the first, involving an Il-86, in the past 22 years of their operation. Il-86 is considered to be one of the most reliable airliners both in Russia and abroad. At the present time Russian air carriers operate 73 Il-86 aircraft.



The Interstate Aviation Committee's Aviation Register revived the Il-86 certificate on 25 February 2003, having introduced temporary limitations to the flight manual of aircraft of this type. The newly introduced limitations ban employing the stabiliser for handling and trimming the aircraft at an altitude of less than 120m at takeoff and less than 200m during landing. IAC considers measures adopted to be necessary and sufficient for providing flight safety of Il-86 aircraft.

Air crash in East Timor

On 31 January 2003, an Il-76 transport aircraft crashed on East Timor's northern coast when carrying out final approach to the Baucau airport in adverse weather, killing its six-man strong crew (five Russians and a Byelorussian). The aircraft was ferrying equipment from China for a Portuguese telephone company operating in East Timor. The aircraft, which sported Laotian registration number RDPL-34141, belonged to the UAE Express Avia air carrier and was chartered by the Laotian Euro-Asia Aviation air carrier.

The Il-76 in question was manufactured in 1986. Prior to the crash it had been in service with the Soviet Air Force and had had registration number 76562. After the break up of the USSR the aircraft was in the inventory of the Ukrainian Air Force and was later on leased to a foreign air carrier.

Witnesses were quoted as saying that the Il-76 failed several times to land at the Baucau airport, situated 100km from Dili,

the capital city of East Timor, due to heavy fog. After three attempted landings the aircraft crashed into a hill five kilometres from the airport due to zero-zero visibility, when carrying out yet another final approach. The airliner's debris was scattered over an area of several hundred square metres in the jungle around Baucau.

An international committee, comprising Russian experts, was tailored to investigate the cause of the crash. According to Aleksandr Neradko, Deputy Minister of Transportation of Russia and head of the Russian Civil Aviation State Service, "causes of similar accidents usually comprise a variety of factors such as errors of the crew, insufficient meteorological and radar support, etc". Mr. Neradko believes that, unfortunately, accidents like that remain most widespread both in civil and military aviation, and do not spare even cutting-edge aircraft, fitted with state-of-the-art avionics and manned by seasoned crews.

Cosmonautics

Russian space launches slated for 2003

In 2003 the Russian Aviation and Space Agency Rosaviakosmos plans to carry out 16 spacecraft launches within the framework of the Federal Space Programme, and ten launches in compliance with commercial contracts. 16 carrier rockets are to be launched from Baikonur Cosmodrome, seven rockets from Plesetsk, and three carrier rockets are to be launched from submarines, deployed in the Barents Sea.

The Russian Space Forces will participate in launching 36 spacecraft, comprising 24 launches within the framework of the Federal Space Programme, and 12 launches for the benefit of the Russian MoD. At a press conference Colonel General Anatoly Perminov, Commander-in-Chief of the Russian Space Forces, briefed journalists that there were 97 Russian spacecraft, flying in the orbit, including 61 spacecraft, belonging to the MoD, as of early 2003. The number of Russian spacecraft in the orbit has decreased two-fold as compared to that in 1989

(back then the orbit housed about 200 spacecraft), but they have been replaced with new spacecraft since that time.

One of the main challenges, facing the Space Forces this year and in the near future, is to restore the satellite constellation, supporting the GLONASS global positioning system. According to General Perminov, in 1995 the constellation in question totalled 24 spacecraft, while by the present time it has been cut back considerably. Two launches of carrier rockets, carrying three satellites each, are slated for mid and late 2003. In addition to that developers have been tasked with extending the service life of navigation satellites from three to 7-10 years, which will enable the GLONASS GPS system to efficiently operate with fewer launches required.

Besides the Space Forces are expected to complete the Soyuz-2 (Rus) space rocket complex, designed to launch Soyuz-2 carrier rockets from Plesetsk Cosmodrome.

Progress M-47 in orbit

On 2 February 2003 at 15:59 hours Moscow time Rosaviakosmos launching teams jointly with combat crews of the Russian Space Forces launched the Soyuz-U carrier rocket, carrying the Progress M-47 freighter, off the fifth launcher of launch pad 1 at the Fifth Baikonur State Cosmodrome. At 16:08 hours the Progress M-47 spaceship jettisoned the last stage of the carrier rocket and orbited with the following parameters: orbital inclination – 51.65 degrees; orbital period – 88.5 minutes; perigee altitude – 193km; apogee altitude – 233km. The spaceship's weight totalled 7,230kg. It carried about 2.6t of cargo for the crew of the ISS space station, including 870kg of fuel, as well as food supplies, and equipment for conducting experiments and fitting the space station. Progress M-47 was the tenth freighter to reach the International Space Station.

On 4 February 2003 at 17:49 hours after a two days' autonomous orbit flight the Progress M-47 transport automatically docked and mated with the ISS, using the axis docking unit of the Zvezda service module. At the present time the ISS space station, featuring a weight of about 180.4t, comprises the following components: the Zarya cargo hold, the Zvezda service module, the Pirs docking module, the Progress M-47 freighter, the Soyuz TMA-1 manned spaceship, the US Unity and Destiny modules, and the Quest lock chamber. The station orbits with the following parameters: maximum altitude – 408km, minimum altitude – 384.5km, orbital period – 92.2 minutes. Onboard equipment of spaceships and modules operates as predicted.

Russia and USA continue ISS development

Russia and the US intend to continue developing the International Space Station (ISS), despite the fact that all flights of US space shuttles were suspended after the Columbia crashed on 1 February 2003. At the same time it is a must to drastically step up the number of launches of Russian spaceships, both Progress-type freighters, and manned Soyuz-type spaceships, in order to maintain the ISS operational. In fact, Russia will be the one to shoulder the burden of flying supplies to the ISS and changing its crews this year. According to Yuri Koptev, Director General of Rosaviakosmos, it will be necessary to launch four freighter spacecraft to the ISS this year, if the station retains its three-man strong crew. Should US shuttles fail to resume their flights in 2004, it will take six Progress launches to supply the space station next year. At the same time Russia does its utmost to support the ISS project, but expects assistance from her partners.

The next expedition to the ISS is to be launched on the Soyuz TMA-2 spaceship from

Baikonur early this May. On 13 March the following composition of the new crew was finally adopted: Yuri Malenchenko and Edward Lu (Aleksandr Kaleri and Michael Foale as a backup crew). The next expedition to be launched to the ISS in autumn 2003 on the Soyuz TMA-3 will comprise Aleksandr Kaleri, Michael Foale, and Spanish astronaut/researcher Pedro Duke (Valery Tokarev and William McArthur being a backup crew). The Spaniard is in for a short flight in compliance with a commercial contract, signed by Rosaviakosmos and ESA.

The following two crews will train to fly US shuttles to

the ISS: the principal crew comprising Sergei Krikalev, Sergei Volkov, and John Phillips; and the backup crew incorporating Gennady Padalka, Oleg Kononenko, and Michael Fincke. Krikalev's crew will be the first to fly the very first shuttle (STS-114 programme) to the International Space Station, as soon as shuttle flights are resumed.



Baikal tests to start in 2006

Flight tests of the Baikal recoverable booster, designed for the new versatile modular Angara carrier rocket, are expected to start in 2006. At the same time it was decided to alter the tests procedure in order to reduce time and costs. For instance, initially Baikal was supposed to be delivered to a certain altitude onboard such platforms as An-124, or VM-T, then dropped and brought in, whereas now it is supposed to take off on its own. With this end in view, it is planned to be fitted with a more powerful AL-31F turbofan (initially it was planned to be powered by the RD-33 power plant).

Baikal will progress through the tests as follows: a conventional aircraft takeoff and flight at a range of up to 500km from the launching site, then the power plant will be shut down, then restarted, and then perform a conventional aircraft flight to the landing site. Thus, after the power plant is

restarted at an altitude, Baikal will be tested in its standard operational mode.

The first test launches of Angara 1.1 and 1.2 carrier rockets (without the recoverable module, but with an expendable booster) will have been carried out by the time Baikal is test-flown. After about ten test flights of Baikal, integrated tests of the rocket systems proper, comprising the Angara carrier rocket, fitted with one or several Baikal recoverable boosters, may get under way. The heavy version of the Angara carrier rocket will be fitted with four Baikal boosters, the medium-weight modification with two boosters, while the light one with just a single Baikal. According to experts, the Baikal booster, mounted on Angara carrier rockets, will cut back costs of launching a payload to the orbit



two- to three-fold. Baikal is expected to carry out up to 100 launches.

The Khrunichev State Space Research and Production Centre is the flagship developer of the Angara system. The Molniya Scientific Industrial Association is responsible for designing the Baikal recoverable booster, carrying out its ground and flight tests, as well as delivering assemblies, units, and spare parts.

Dnepr to launch French, US and German satellites into orbit



Early this year Russo-Ukrainian Kosmotras JSC, tasked with converting RS-20 (SS-18 Satan) ICBMs being phased out into Dnepr carrier rockets, secured a contract with the French National Space Research Centre (Centre National d'Etudes Spatiales (CNES)) on launching the DEMETER spaceship in the second quarter of 2004.

By now Kosmotras has organised three successful launches of the Dnepr conversion carrier rocket. The rockets in question launched 12 spacecraft from the UK, Italy, Saudi Arabia, Malaysia, Germany, and the USA in 1999, 2000, and 2002.

Under the commercial contract with the US TransOrbital Company, the Dnepr carrier rocket is to launch the Trailblazer space station to the Moon in 2003. In addition to that, last year Kosmotras signed a contract with German Astrium GmbH to launch the Terra SAR-X spacecraft, designed to solve scientific and commercial problems, with the help of the Dnepr carrier rocket in 2005.

French equipment for Russian satellites

The Russian Kosmicheskaya Svyaz State Enterprise (GPKS) and French Alcatel Space signed a contract on producing and delivering payload modules for new Express-AM2 and Express-AM3 communications and broadcast satellites. The two payload modules, manufactured at the Alcatel Space plant in Toulouse, France, are expected to be mounted on the Express-AM satellite, being developed by the Reshetnev scientific industrial association of applied mechanics, based in Zheleznogorsk, Russia. Prior to that telecommunications equipment for Express satellites was to have been delivered by the Japanese NEC company, but the results of the tender have recently been revised, and preferences given to French Alcatel.

First Strela carrier vehicle launch to be held this year

The first launch of the Strela light carrier rocket from the Svobodny State Cosmodrome in the Amur region may be held as early as November 2003. Before that in the third quarter of 2003 the rocket in question is expected to undergo flight tests at Baikonur Cosmodrome, envisaging a demonstration launch of a spaceship mock-up to the near-

earth orbit with the help of the Strela carrier rocket.

The Strela carrier rocket is being developed by NPO Mashinostroyeniya scientific industrial association, based in Reutov outside Moscow. The rocket is based on two stages and the dispensing mechanism of the RS-18 (SS-19) intercontinental ballistic missile (ICBM), which is

leaving the inventory of the Russian Strategic Rocket Forces in compliance with the Pragmatichny Kosmos (pragmatic cosmos) programme. The programme envisions converting RS-18 ICBMs into Strela light carrier rockets and building Svobodny Cosmodrome, which is to succeed a former division of the Strategic Rocket Forces, deployed in the Russian Far East.



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RUSSIANS IN LATIN AMERICA

RUSSIAN AND UKRAINIAN AIRCRAFT IN SOUTH AND CENTRAL AMERICA

Russia's total military materiel exports in 2002 equalled \$4.8 billion. Mikhail Dmitriyev, Deputy Minister of Defence, Chairman of the Russian Committee for military and technical cooperation with foreign countries, was quoted as saying in an official statement, that it was the all-time high figure for national arms exporting companies.

Military aircraft traditionally account for a considerable share in Russian arms exports, and last year was not an exception. As is known, the Russian defence industry has recently been deriving the lion's share of its profits from arms exports to China and India. However, Russia has long been determined to promote her arms in other corners of the compass, including Latin America.

Russia secured her niche in this particular market a long time ago, but back at the Soviet times the geography of her defence industry cooperation in this region was limited primarily to communism-oriented states, first and foremost, Cuba and Nicaragua. Securing a number of big-ticket contracts on delivering combat aircraft to Peru was something of a breakthrough in the Latin American market in the 1970s. Last year the country in question celebrated the 25th anniversary of fielding supersonic Su-22 fighter-bombers, which are still in the inventory of the Peruvian Air Force.

The situation drastically changed in the 1990s, when, having given up the political doctrine, the Russian government embarked on developing defence industrial relations with other Latin American states, including Brazil, Venezuela, Colombia, Mexico, and some other countries. At the same time Ukraine and Belarus also became quite active in the local market and signed a number of profitable contracts on delivering Antonov transports and used combat aircraft, they inherited after the break-up of the Soviet Union.

At the present time Russian combat aircraft are still widely operated by Cuban and Peruvian air forces, Russian helicopters are in service with armed forces of Venezuela, Guyana, Colombia,



Costa Rica, Mexico, Nicaragua, Paraguay, and Ecuador, while several other states employ Russian- and Ukrainian-produced freighters and passenger airliners. Russia participates in several big-ticket arms procurement bids and conducts negotiations with Brazil, Venezuela, and several other states of the region to this end. It is highly likely that in the near future the number of countries, operating Russian military aircraft, may increase.

A short review of the present status of Soviet- and Russian-produced aircraft in the inventory of Latin American states, based on various foreign sources, is given below (as of early 2003).

ARGENTINA

The Argentinean Air Force has been operating eight piston-engine Su-29AR aerobatics aircraft since 1997. In 1998 they were fielded with the Southern Cross aerobatics squadron (the 4th Squadron of the 4th Fighter Detachment), which was the only unit in the national Air Force to carry out demonstration flights on national and

international holidays. Su-29ARs became the first and so far the only Russian aircraft in service with the Argentine.

BERMUDAS

There are no Russian aircraft on the Bermuda Islands, but Boeing 737, Boeing 777, and Airbus A310 passenger airliners, operated by the largest Russian Aeroflot air carrier, are registered there.

BOLIVIA

The Bolivian AeroSur air carrier (AeroSur, Compania Boliviana de Transporte Aereo Privado Aerosur), founded in 1991, operates a Yak-40 regional passenger jet, leased from Expresso Aereo. The Aerodinos Company also employs An-2 transports.

BRAZIL

At the present time Brazil is the largest Latin American state, which enjoys one third of the total arms market turnover in the region, which is estimated at \$1 billion annually.

The first contracts between Russia and Brazil in the sphere of defence industry were signed as far back as 1991, while three years later Russia brokered the first deal, envisioning exporting to Brazil a batch of Igla shoulder-fired air defence systems.

Two years ago Russia participated in the bid to deliver 24 contemporary fighters to the Brazilian Air Force. The Su-35 fighter, promoted

Su-29AR aerobatic aircraft are the only assets of Russian make in service with the Argentinean Air Force



Top page: Peruvian pilots have been flying Russian Sukhoi-series aircraft for twenty five years now

by Rosoboronexport and supported by the Brazilian Avibras Aerospacial Company, had to compete with such rivals as the French Mirage 2000BR, offered by Dassault and supported by Brazilian Embraer, and the Swedish-British Gripen. In June 2002 Brazilian mass media reported that the Brazilian Air Force intended to award the contract to the Russian Su-35, and that an official statement of intent might be released shortly afterwards. Back then Joao Brasil, Avibras Aerospacial Director, was quoted as saying that "Su-35 stood a chance of about 90 per cent". Part of the Su-35 production was expected to have been established at Brazilian plants, and a joint Sukhoi-family aircraft maintenance centre project was discussed.

However, following a large-scale Mirage 2000BR advertising campaign, carried out by Dassault and Embraer via all local mass media, the Air Force authorities once again put off the decision: first for a month, and then until 2003. However, in 2003 Brazil elected a new president, Luiz Inacio Lula Da Silva, who immediately scrapped the tender for procuring new aircraft for the Brazilian Air Force for a total value of \$750 million to 1 billion. Thus, the new president embarked on realising his anti-poverty and anti-hunger election ticket. Financial assets, earlier earmarked for filling the needs of the Air Force, will be re-directed to solve the very two problems.

Brazil intended to address the issue of upgrading the aircraft fleet of its Air Force within a year. However, soon the president's press secretary said that "the possible refusal to procure new fighters did not mean that the new government was not going to upgrade national armed forces". A short time later the Brazilian Defence Ministry stated that it was going to lease "12-18 not too obsolete combat aircraft", instead of procuring new fighters. As a result, the total cost of the future contract will be cut back seven- to eight-fold. Under the bid conditions, the first five aircraft are to be delivered to Brazil two years after the contract has been carved in stone. Given the new requirements, Rosoboronexport jointly with Avibras offered the Brazilian Air Force 12 Su-27SK fighters, manufactured by KNAPO earlier on, but which boast almost no flying time. The Russian aircraft's rivals included used F-16s with a considerable flying time, offered by US Lockheed Martin jointly with Brazilian Varig, as well as Israeli Kfir-C10. The Brazilian government is expected to select the fighter type and award the contract any time now.

Besides the fighter tender, the Brazilian Air Force also planned on announcing a bid for heavy transport helicopters. The major competing aircraft were supposed to have been the Russian Mi-26 and the US Chinook. The Americans offered a new version of their helicopter (yet to be developed), which featured a number of design modifications and a greater lifting capacity as compared to mass-produced aircraft. The Russian Rostvertol company offered the Brazilian Air Force the helicopter, which had already been launched into series production, and which has boasted the greatest lifting capacity in the world up to date. Another important factor, favouring the Russian offer, was the fact that Mi-26 helicopters had already been operated by two Latin American states (Peru and Mexico) and had lived up to their high characteristics in the local weather conditions. However, the fate of the helicopter bid, just like that of the fighter one, seems to be unclear so far.

COLOMBIA

The Russo-Colombian defence industry cooperation became possible after a corresponding intergovernmental agreement was signed in 1996. This agreement became the first one, signed between Russia and a Latin American state in the sphere of defence industry. As a result, early 1997 saw securing a contract on delivering ten Mi-17-1V helicopters to the Colombian Armed Forces (Ejercito De Colombia). The helicopters in question are employed to counter rebels, drug traffickers, carry out mede-

vac operations, airlift troops, arms, and other cargo.

Given positive experience of operating Mi-17-1V helicopters in Colombia, the national government signed a new contract on procuring another batch of six Mi-17-1Vs in August 2001. The helicopters were delivered in 2002.

Besides the Colombian Armed Forces, several civilian air carriers also operate Russian (Soviet) aircraft. The SELVA Colombia (Servicios Aereos del Vaupes) air carrier, set up in 1978, operates two An-32B turboprop transports. Another two leased An-32Bs are in service with the SAEP air carrier (Servicios Aereos Especializados en Transporte Petrolero), founded in 1980. Colombian air carriers also operate a considerable number of Russian helicopters: Heliandes has four Mi-17s, Helitaxi employs 16 Mi-17s, while Helitec flies two Ka-32s.

COSTA RICA

Costa Rica has not had any armed forces since the end of the civil war in 1948, and military aircraft are only in the inventory of the civil guard (Guardia Civil), and the subordinate border police (Policia de Fronteras). Most of the 12 fixed- and rotary-wing aircraft in the inventory have been imported under the US aid programme. Among them there is a Mi-17, procured from Nicaragua, which is used to fly patrol missions and airlift cargo.

CUBA

Cuba is undoubtedly the most significant importer of Russian aircraft in Latin America. Almost the whole of aircraft fleet of the national Air Force is represented by fixed- and rotary-wing aircraft, produced either in the USSR or Russia. Russian and Ukrainian aircraft also constitute the backbone of aircraft fleet of three Cuban air carriers.

Cuba was the first Latin American state to receive arms from the USSR. After the revolution of 1959 and the final break-off of all relations between the pro-Marxist Cuban government and the USA, the Cuban government embarked on rearming the Cuban Revolutionary Air Force (Defensa Antiaerea y Fuerza Aerea Revolucionaria (DAAFAR)) with Soviet-produced aircraft in 1961.



Another batch of Mi-17-1V multipurpose helicopters was fielded with the Colombian Army last year

Yak-42D passenger plane is one of the newest assets making up the Russian-made fleet of Cuba's leading Cubana Airlines





MiG-29s are the most sophisticated aircraft in service with the Cuban Air Force, yet most of them are earthbound due to lack of spare parts and components

By the late 1980s in excess of 120 MiG-21MF, MiG-23MS, and MiG-23MF fighters had constituted the mainstay of the Cuban Air Force. In order to upgrade the combat aircraft fleet in service with this small insular country, the Cuban government ordered a batch of fourth-generation MiG-29 fighters from the USSR.

However, the Soviet aid to Cuba was not limited to fighter exports: the Soviet Union also supplied the only Socialist country in the Western hemisphere with a considerable number of various helicopters (Mi-2s, Mi-8s, Mi-14s, and Mi-24s), as well as transport aircraft (An-2s, An-26s, An-32s, and Il-76s). The Cuban civil aviation also consisted of Soviet-produced aircraft. The civil aircraft fleet comprised both Il-18 and An-24 turboprops, and the most cutting-edge (at that time) Il-62M, Tu-154, Yak-40, and Yak-42D airliners. According to various estimates, the USSR delivered a total of 400 combat aircraft and about 80 transports to Cuba. The number of only Mi-8/Mi-17-family helicopters, exported to Cuba, totalled in excess of eight dozen.

At the present time the Cuban Air Force and Air Defence Forces (Defence Anti-aerea y Fuerza Aerea Revolucionaria) are fielded with only Russian fixed- and rotary-wing aircraft. Cuba still boasts one of the largest air and air defence forces in Latin America, but their efficiency decreased drastically, when the USSR stopped providing aid due to slumping national economy. According to experts, almost a quarter of the total aircraft fleet of the Cuban Air Force is not combat ready, and the situation is only likely to aggravate in the future.

At present the Cuban Air Force operates 20 MiG-29 fighters (including two MiG-29UB combat trainers), 45 MiG-23BN fighter-bombers, 20 MiG-23MF fighters, four MiG-23UB combat trainers, and almost 200 various modifications of MiG-21 (including 18 MiG-21U/UM tandem aircraft). Despite the fact that Cuba has the most powerful Air Force in the region, financial problems and lack of spare parts keep most of these powerful aircraft grounded. According to the London-based think-tank, the International Institute for Strategic Studies, at the moment the Cuban Air Force has only three really combat ready MiG-29s, ten MiG-23s, and a maximum of

five MiG-21bis aircraft! Thus, the issue of overhauling and upgrading the existing aircraft is the foremost one for the Cuban Air Force authorities.

The helicopter fleet of the Cuban Armed Forces comprises six Mi-2 light utility helicopters, 36 Mi-8 medium transports, 14 Mi-17s, 14 Mi-14PL ASW helicopters, and 12 Mi-24D (Mi-25) army combat transports. The military transport aviation operates 20 An-2 piston-engine biplanes, four An-24 passenger planes, 20 An-26 and two An-32 transports, two Yak-40 jets, and one An-30 photo-reconnaissance aircraft.

The largest Cuban air carrier Cubana (which has been called Empresa Consolidada Cubana de Aviacion since 1959), founded in 1929, earlier on operated up to 70-90 passenger planes and over 30 freighters. After the break-up of the Soviet Union deliveries of new aircraft ceased and spare parts became scarce. Former Cubana aircraft were handed over to other national and foreign air carriers. That is why at the moment Cubana boasts just a shade over 20 aircraft.

Half of 29 long-haul Il-62s/Il-62Ms were leased from Aeroflot, the Romanian Tarom air

Aerocaribbean, another Cuban air carrier. Earlier on Cubana operated 19 An-24V/RV turboprops, and 18 Yak-40 regional jets (nowadays most of them have been handed over to Aerocaribbean and Aerogaviota air carriers).

Cubana also used to operate a considerable fleet of freighters: two Il-76MDs, one An-12BP, 33 An-26s and An-26Bs. Most An-26s were transferred from the Cuban Air Force and later on handed over to Aerogaviota.

At present Cubana employs only six long-range Il-62M airliners, three Yak-42D short-haul aircraft, five An-24RV regional planes, and two Il-76MD transports.

The Aerocaribbean air carrier (Empresa Aero Caribbean) flies five Il-18D/Vs, six Yak-40s, one An-24, and three An-26s. Four Yak-40s, two An-30s, 21 An-26s and An-26Bs, 15 Mi-8s, and one An-2 are in service with the Aerogaviota air carrier (Empresa de Aviacion Aerogaviota). Most aircraft have been obtained from the Cuban Air Force. The Aerotaxi air carrier boasts about 40 An-2 aircraft.

THE DOMINICAN REPUBLIC

At present this Latin American state does not have any Russian-produced aircraft, but military brass of the Dominican Republic are expressing their interest in modern Russian fighters and are ready to discuss the feasibility of procuring them in the near future. In particular, Air Force Major General Virhilio Sierra, Chief of Staff, Air Force, expressed the desire to fly a MiG-29 personally after a visit to Russia, aimed at examining Russian combat aircraft.

ECUADOR

Ecuador enjoys one of the best air forces in Latin America, but the share of Russian aircraft in service with the Ecuadorian Air Force is



Mi-17-1V helicopters have been part of the Ecuadorian Air Force inventory for six years now

carrier, and China. They were employed for flights to Europe, primarily to the Soviet Union. Most Il-62s are no longer operational. There were about ten narrow-body Tu-154Bs/B-2s/MS, seven Yak-42Ds, and ten Il-18V/D turboprops. The remaining Il-18s were handed over to

insignificant. In 1997 the Ecuadorian Army procured seven Mi-17-1V helicopters, but two of them were lost later on.

In 1997 after Peru procured a batch of MiG-29s from Belarus, Ecuador started negotiating with Russia on importing 12



In 2000 Mexico became a second Latin American nation operating the world's largest Mi-26 heavy-lift helicopters



As many as ten An-32 transports are currently in service with the Mexican Air Force and Navy

Su-27/Su-30-family aircraft (later on replaced by MiG-29s). However the deal in question had never been struck for a number of reasons. Later on Ecuadorian authorities resumed negotiations on procuring MiG-29s with Ukraine, which offered second-hand aircraft at a considerably lower cost. However, Soviet-produced (Russian-produced) fighters are yet to make their appearance in Ecuador.

GUATEMALA

The Aguilas Mayas Internacional air carrier operates a Yak-40 passenger jet, procured from the Cuban Cubana air carrier, and one An-2 piston-engine biplane.

GUYANA

Guyana Defence Force Air Corps operates a small fleet of 12 aircraft, incorporating, in particular, two Mi-8T medium transport helicopters, deployed at the Georgetown airport. Guyana has imported a total of three Mi-8Ts, but at present one of them is not operational and is being cannibalised for spare parts for the two remaining helicopters.

The Guyana Air 2000 air carrier, founded in 1939, (which has been sporting this particular name since 1999) operates one Il-62M long-haul airliner, leased from Aeroflot, two Tu-154B-2 medium-haul airliners, leased from the Romanian Tarom air carrier, and one Tu-154M.

HONDURAS

The RollinsAir air carrier, flying one Yak-40 regional passenger jet, which earlier belonged to one of the Russian air carriers, has been operating in Honduras since 1999.

MEXICO

The first Russian aircraft made their appearance in Mexico in late 1994, when the national Armed Forces procured the first eight Mi-8MTV (Mi-17V) helicopters, having broken up the US and West European monopoly on delivering aircraft to Mexico.

In 1997 the Mexican Air Force continued to procure Russian helicopters - a total of 11 Mi-8s and 24 Mi-17s have been procured in various batches up to date. They are currently in the inventory of the 303rd Squadron of the 3rd Air

Detachment, deployed in Santa Lucia (Mexico). Another six Mi-8s (Mi-17s) are in service with the Emergency Rapid-Reaction Forces, deployed at the same airbase. The aircraft mentioned above along with two heavy Mi-26 military transport helicopters, and four An-32V transports were delivered in 2000. They were supposed to be used for disaster-relief operations (earthquakes, storms). The Mexican Air Force also operates two light Mi-2 helicopters, delivered in 1999 and 2000. Four Mi-17s (one is not operational at the moment) are in the inventory of the federal police.

In April 2000 Mexican naval aviation procured four Mi-2 light helicopters, used for patrolling littoral areas and airlifting airborne troops (up to five soldiers) and various cargo, as well as another four Mi-8 medium transports.

NICARAGUA

The Nicaraguan Air Force (Fuerza Aerea Sandinista, FAS) was established in July 1979, when Anastacio Somoza's regime was toppled. Soon it started importing Russian aircraft, which

it operated alongside US, Spanish, and Israeli fixed- and rotary-wing aircraft, inherited from the previous regime. The first Mi-8 helicopters were delivered to Nicaragua in 1981. Over the years the country in question imported from the USSR ten Mi-8 and 48 Mi-17 medium transport helicopters, 18 Mi-24 (Mi-25) army combat transports, ten An-2 piston-engine biplanes, seven An-26 turboprop transports, and nine Mi-2 light helicopters.

At least five Mi-8s were lost in the struggle between Somoza's supporters and sandinists. In 1990 sandinists left the government, and FAS became part of the Nicaraguan Armed Forces and were called Air Force of the Nicaraguan Armed Forces (Fuerza Aerea del Ejercito de Nicaragua). In 1992 12 Mi-17 and seven Mi-24 (Mi-25) helicopters were sold to Peru. The only remaining Mi-25 became a monument outside the Air Force headquarters in Managua. Many An-2s and Mi-17s, imported by sandinists, were sold to various Central American organisations.

At the present time Nicaragua operates three piston-engine An-2s (only one of which is oper-



A Mi-17-1V helicopter of the Mexican Navy. A total of 60 Mi-8 and Mi-17 helicopters are currently employed by the Mexican Armed Forces

The Nicaraguan Air Force operates 15 Mi-17 helicopters, half of them awaiting repairs





One of the first Peruvian Su-22 aircraft in colorful paint participating in the celebration of the 25th Anniversary of fielding the assets with the national armed forces; the festivities were held on 20th September 2002

ational) and three An-26 turboprops (only one operational), which are assigned to the transportation squadron. Only half of the remaining 15 Mi-17s in service with the Nicaraguan Air Force are operational, while the existing Mi-2s are all grounded. In January-February 2001 Nicaraguan Mi-17s jointly with helicopters of other states participated in the earthquake-relief operation in El Salvador.

The Aeronica air carrier (Aerolineas Nicaraguenses), which employed one Tu-154M passenger airliner, two An-26 and two An-32 transports, operated in Nicaragua in 1981-92. In 1992 it was succeeded by the Aero Servicios air carrier, which operated one An-32, however it ceased to exist five years ago. At the moment the afore-mentioned aircraft is in service with the national Air Force. At the present time the AeroSegovia air carrier, registered in Panama, operates in Nicaragua. It flies one An-24 and one An-26, procured from Ukraine, on domestic flights.

Russian and Nicaraguan authorities signed an agreement on military technical cooperation in Managua on 24 October 2001. This agreement paves the way for developing links between Russia and Nicaragua in this sphere and lays the groundwork for promoting friendly relations between Russia and Nicaragua, based on the principle of legal continuity.

PANAMA

The Las Americas Cargo air carrier (Aerovias Las Americas), established by the Panamanian civil aviation authority, operated in Panama in 1993-94. Among other aircraft it operated three An-32B turboprop transports. In addition to that another An-32, which belonged to a private individual and was sold to the Colombian Air Colombia air carrier in 2001, also flew in the Panamanian skies.

PARAGUAY

The Paraguayan police employ one Mi-8T for anti-drug operations.

PERU

Large-scale deliveries of Soviet aircraft to Peru started in the mid 1970s, when the USSR exported the first Mi-8 and Mi-6 helicopters, Su-22 fighter-bombers, and An-26 transports. In 1983 Peru procured a batch of Mi-24D (Mi-25) army combat transports from Nicaragua. Two

dozen Su-22s and six Su-22Us were joined by 12 more efficient Su-22Ms. From 1990 until 1995 Russia delivered to Peru about 40 Mi-8T and Mi-17 utility transports (including 18 Mi-17-1Vs) and eight Mi-24 (Mi-35) combat transports.

In 1996 under the national Air Force modernisation programme Peru procured from Belarus 18 fourth-generation MiG-29 fighters (including two MiG-29UB two-seaters) and 18 Su-25 attack aircraft (including eight Su-25UB two-seaters), which used to be in the inventory of the Soviet Union. Another three new MiG-29s were delivered to Peru by Russian Aircraft Corporation MiG in 1998.

On 13 December 2002 Peruvian President Alejandro Toledo ordered Defence Minister Aurelio Loret de Mola to establish links with the Russian government in order to conduct negotiations on cooperation in providing maintenance to Soviet-produced fixed- and rotary-wing aircraft in service with the Peruvian Air Force and Army, as he stated that at the moment most aircraft and helicopters in the inventory of the army aviation and the Air Force were in "a very bad condition". Following the crash of a MiG-29, operated by the Peruvian Air Force, on 13 March 2001, Peruvian



Mi-8T helicopters in service with the Peruvian Navy fitted with radars

Su-22M fighter-bomber is still the major strike aircraft of the Peruvian Air Force. Su-22Ms are still in service with the 11th Air Group



mass media unleashed a campaign, aimed at discrediting Russian aircraft. However, the aircraft in question was not delivered by the MiG corporation, but procured from Belarus in 1996 unbeknownst to the designer. Given this fact the MiG corporation did not provide any guarantees to the Peruvian Air Force with respect to the aforementioned aircraft. At the same time MiG is held fully responsible for the three aircraft, it delivered itself, but there have been no complaints about them so far. As a response to the anti-Russian aircraft campaign Russian Aircraft Corporation MiG offered to examine the MiG-29 fighters, pro-



MiG-29 fighter of Russian produce is the most advanced aircraft of the Peruvian Air Force. 18 fighters of the type were procured from Belarus in 1996, three aircraft were later bought from Russia. All the assets are in service with the 6th Air Group of the Peruvian Air Force



Su-25 ground attack aircraft imported in 1996 from Belarus are employed by the 11th Air Group of the Peruvian Air Force

cured by the Peruvian Air Force from Belarus, and provide maintenance, after a corresponding agreement was signed.

Six Il-103 light piston-engine aircraft, used as trainers in the Peruvian army aviation and procured in 1999, became yet another batch of aircraft, purchased by Peru from Russia.

At the present time Russian aircraft account for almost three quarters of the total aircraft fleet of the Peruvian Air Force, which includes the following aircraft: 18 MiG-29 fighters (including two MiG-29UBs), 18 Su-25 attack aircraft (including eight upgraded two-seat Su-25UB combat trainers, which feature advanced combat capabilities), 20 Su-22, Su-22M, and Su-22U fighter-bombers, three Mi-8T utility helicopters, 35 Mi-17 and Mi-17-1V utility transports, 12 Mi-25 combat transport helicopters, 12 Mi-2 utility helicopters, and in excess of 20 An-32 turboprop transports. The Peruvian army aviation (Aviacion Del Ejercito Peruana) operates four An-32 transports, six Il-103 training aircraft, three Mi-26 heavy military transports, 26 Mi-8T medium transport helicopters, and 13 Mi-17s. There are two An-32 transports and four Mi-8 helicopters in the inventory of the Peruvian naval aviation (Servicio Aeronaval de la Marina Peruana).

All fixed- and rotary-wing aircraft, delivered to Peru from the USSR before the early 1990s, were intended to be employed only in the Peruvian Armed Forces. After 1991 both civil air-

craft and ex-Soviet pilots started to arrive in Peru. They were employed by several air carriers.

The Imperial Air carrier, which among other aircraft flew four Russian Tu-134A/A-3 medium-haul jet airliners, and four Ukrainian An-32 turboprop transports, operated in Peru in 1992-97. The Star Up air carrier, which nowadays operates two An-24RVs, was founded in 1998. The year of 1998 also saw establishment of the TAR AeroRegional air carrier (TAR, Transporte Aereo Regional), which at the moment operates one Yak-40 regional passenger jet, and two An-24RV turboprops. There is also the Lima-based Colibri carrier (Servicios Aereos Colibri), which has one An-32B freighter. Russian helicopters are employed by the following three Peruvian air carriers: Aviasur (two Mi-17s), Helicusco (one Mi-8AMT and one Mi-17), and Helisur (14 Mi-17s).

VENEZUELA

At the present time the Venezuelan Air Force operates 18 Mi-17 transport helicopters. Having tested Russian rotary-wing aircraft and having examined Russian aircraft at a number of international air shows, the military brass expressed their

interest in procuring other types of Russian aircraft. Venezuela is especially interested in MiG-29 fighters and future MiG-AT trainers. Russian Aircraft Corporation MiG has already carried out several demonstrations of upgraded MiG-29s for Venezuelan Air Force representatives, including demonstrations in Venezuela proper, where Russian fighters have been estimated highly.

In addition to helicopters, several Venezuelan air carriers operate Russian and Ukrainian aircraft. For instance, in 1995-1999 Oriental de Aviacion operated four Yak-40 regional passenger jets, which had earlier been in service with Cuba, and one An-26 turboprop transport. An ex-Russian An-26 is privately owned there.

Gobernacion Estado Amazonas employs two An-2 transports. Another four aircraft like that are operated by the Aerobol (Aerovias Bolivar) air carrier, At La Montana and Rutaca (Rutas Aereas) air carriers have three An-2s each, and Comeravia operates one An-2. The latter air carrier also has a larger two-engine An-28 turboprop. A similar aircraft is in service with CIACA Airlines. The aircraft fleet of the Helitec air carrier comprises two Mi-8T helicopters.

The following sources were used in writing the article: Directory: World Air Forces (Flight International, 27 November – 3 December 2001); World Air Forces Directory 2002/2003 (edited by I.Carroll, Mach III Plus, UK, 2002); Aerospace Encyclopedia of World Air Forces (edited by D.Willis, Aerospace Publishing/AIRtime Publishing, UK/USA, 1999); Russia in the World Arms Market. Analysis and Prospects (by B.Kuzyk, N.Novichkov, V.Shvarev, etc. Military Parade, Moscow, 2001), as well as news bulletins: Military Technology Cooperation (Ed. N.Novichkov), Russia in the Arms Market (2001-2002) and Interfax-AVN on-line news.

GENERAL MIKHAILOV:

"RUSSIAN AIR FORCE IS COMBAT READY AND PREPARED TO FIGHT"



On 15 January the Russian Air Force Command held a regular annual news-conference to assess the results of the force's operation in 2002 and determine major trends of its development in the coming years. Russian Air Force Commander Colonel General Vladimir Mikhailov and Chief of Air Force Staff Colonel General Cheltsov answered journalists' questions of the branch's present and future activities.

Question: Mr Mikhailov, could you tell us a few words of the results of the Russian Air Force's combat training in 2002?

Answer: In general, the Air Force retained the capabilities gained in 2001 and improved their performance in some aspects of operation. Despite notorious lack of finances, we have managed to carry out some 400 operational and combat training events, some 150 units subject to staff and structure reorganisation.

Tactical aviation aircraft participated in more than 50 tactical exercises, as opposed to 30 in 2001; over 50% of fighter aviation units operating Su-27, MiG-29 and MiG-31 aircraft took part in exercises practising live fire launches on airborne targets. Tactical bomber and ground attack units, using Su-24Ms and Su-25s respectively, performed over 300 launches of air-to-surface munitions, against approximately 200 in 2001. Long-range aviation heavy bomber regiments operating Tu-160, Tu-95MS and

Tu-22M3 aircraft performed more than 10 launches of air-based cruise missiles.

The number of flight hours increased by 25% in 2002, making more than 25 hours for fighter aviation, some 30 for ground attack aviation, over 20 hours for bomber pilots, approximately 25 hours for long-range aviation, and more than 50 hours for military transportation aviation. Corresponding indexes for the year 2001 were 14, 20, 13, 22 and 50 hours respectively.

During the year air defence missile forces accomplished more than 150 record tactical missions, over 90% of air defence missile units conducting live fire exercises. Apart from that, air defence missile battalions on duty without prior warning were dispatched to firing ranges to accomplish various combat missions. All of them attained their objectives.

Radio and electronic warfare forces performed combat exercises in collaboration with air defence missile and aviation units. For the first time in ten years radio and electronic warfare units participated in tactical exercises at the Ashuluk firing range in the Astrakhan region, the total number of exercises performed with participation of radio and electronic warfare units and formations mounting up to 300 events. A special emphasis in training personnel was put on the combined arms complement of the exercises. Radar support of various aviation assets was practised in the course of the tactical exercise along with the forces' conventional tasks.

Some 30 events of tactical and combat training aimed at promoting defence capabilities of CIS nations were carried out in 2002 within the framework of the CIS unified air

Top page: Aircraft to be fielded with the Russian Air Force: Su-32 fighter-bomber (centre) flanked by a pair of Su-27UBs during a test flight at the State Test Flight Centre in the town of Akhtubinsk

defence system. Much has been done by the Russian military to restore air defences of Armenia, Tajikistan, Kyrgyzia, and to upgrade those of Belarus and Kazakhstan. The Boyevoye Sodruzhestvo-2003 joint tactical exercise with live fire launches will be held this year by CIS nations from late August till early September.

Q: Could you provide us with some figures related to the Air Force's mission of guarding the State border of the Russian Federation?

A: The task of guarding the state border of the Russian Federation was no less difficult last year. As many as 45 violations of Russian air space were registered in 2002, against 30 in 2001. The Russian Air Force detected some ten air space violations by drifting aerostats and air balloons (seven in 2001).

The Air Force units charged with air defence tasks detected and tracked more than 200,000 airborne targets (some 150,000 in 2001); foreign aircraft accounted for more than 100,000 objects, including 1,000 combat aircraft and more than 300 spy planes. To prevent possible violations of Russian air space aviation units were put on red alerts 600 times, air defence missile forces some 200 times, radio and electronic warfare troops 2,500 times. Duty aircraft of fighter aviation were called in some ten times.

Q: What about flight safety in Russian Air Force units?

A: Unfortunately, in 2002 two air crashes occurred in the Russian Air Force that claimed lives of three people. The accidents involved a Su-24 and L-39 aircraft. Apart from that, four crashes without casualties occurred, an An-12BK, Su-27 and two L-39s lost in the training regiments in the towns of Michurinsk and Tikhoretsk.

In comparison with the year 2001, the number of aircraft lost decreased from eight to six, casualties going down from 11 to three. Yet the very fact of losing people and assets in air crashes caused, in most cases, by inadequate expertise of pilots deserves close attention. Circumstances of the accidents analyzed, their causes detected, corresponding measures have been taken in order to prevent air crashes in the future.

Q: What are the major trends of the country's Air Force development?

A: Further development of the Russian Air Force will be pursued in compliance with approaches taken by the national leadership to the Armed Forces' reforms and the approved structure of the Russian military. In 2003 the emphasis of the Air Force Command will be put on

- streamlining organisation and combat complement of the Air Force in order to attain an optimum balance between strike and defensive components, combat and support means and assets;

- maintaining adequate level of combat and mobilisation readiness, improving tactical and combat capabilities of the Air Force units and Air Defence troops;

- retaining the Air Force's capabilities to perform tactical manoeuvres, the principal objective being reinforcement of air groups at specified directions;

- modernising in-service assets, completing development of future systems, as well as on building the required scientific and technical basis for future research and development projects;

- improving the Air Defence system and developing the Air and Space Defence system of the Russian Federation.

Q: Are there any projects of upgrading the fleet of in-service aircraft to be implemented in the near future?

A: Upgrade of employed assets is the principal approach to enhancing combat efficiency of the aircraft currently operated by the Air Force. In accordance with the approved Air Force assets' modernisation program for 2001 and 2002, first upgraded versions of Su-24M tactical bombers and Su-25 ground attack aircraft. On the New Year Eve the Su-27SM upgraded fighter made its maiden flight. All the aircraft have been dispatched for upgrade from Air Force units and will continue their service with the branch upon completion of the program. Other assets will follow the trend.

The current upgrade program will be under way till 2005. We expect some 20%-25% of the fighter aviation fleet to be modernised to the 4+ generation standard. After that the Russian Air

Force fighter. Sukhoi has been granted the status of the leading enterprise of the project, yet we are still following related projects pursued by RAC MIG. The Russian Air Force Command expect the first prototype of the Future Tactical Aircraft Platform to make its maiden flight in 2006 or 2007; flight trials are to be completed by 2010, following which mass production of the aircraft will be launched.

Assets operated by long-range aviation are being upgraded, too. Development of new munitions for Tu-160 and Tu-95MS holds much promise. Trials are already under way, so long-range aviation aircraft subject to scheduled modernisation will be fitted with improved armament that will greatly enhance their combat capabilities. Apart from that, we intend to complete production of at least one Tu-160 strategic bomber of the overall number of aircraft to be built. Service lives of other long-range aviation assets will be extended. As a matter of a more distant prospect, future needs of long-range aviation will be addressed with the Future Long-range Aircraft Platform that is now being developed.

A special emphasis will be put on implementing new concepts of aircraft's maintenance and employment. Specifically, maintenance procedures for future aircraft platforms will be determined on the basis of the assets' actual technical status rather than on their service lives and terms of employment as it is now. This will lead to reduced maintenance expenditures.

According to expert assessment, next generation fixed- and rotary-wing aircraft will boast combat capabilities by far better than those of



Tu-22M3 missile-carrying bomber is the most numerous aircraft in service with the Russian long-range aviation

Force intends to field the new Su-32 aircraft of the Sukhoi enterprise, its trials to be completed by 2004-2005. Further development of tactical aviation is related to building the Future Tactical Aircraft Platform. The Air Force Command participated in assessment of the projects submitted by the Sukhoi Design Bureau and Russian Aircraft Corporation MiG. Last year a decision was made to concentrate efforts of defence enterprises on development of the next-genera-

tion fighter. Russian aircraft will be equal and, in some aspects, even superior to their foreign counterparts in regard to their serviceability, design characteristics, survivability, combat efficiency, and versatility.

A special mention should be made of the fact that all work on upgrading Russian military aircraft is being conducted with due consideration of the assets' export potential, so that they could be effectively offered to foreign cus-



Complement of the Russian Air Force Special Air Division based at the Chkalovsky airfield in outside Moscow includes, among other things, Il-80 airborne command post aircraft

tomers. Due to it, modernisation of in-service aircraft and development of prospective ones is being pursued with an option of the assets' technical and informational integration with foreign-made equipment, strike systems, flight and maintenance personnel's training facilities.

Q: Will modernisation of in-service aircraft be the major venue to renewing the Air Force fleet, along with development of prospective systems?

A: Of course, it is vitally important to develop new assets, for they are the future of the Air Force. However, considering the problem, one should take into consideration the fact that it will take some five or seven years, in some cases ten and more, to design a new fighter, and more so a bomber, to test it, mass-produce and field with the forces, and we need improved aircraft today. That is why I believe that the principal emphasis in the years to come should be put on upgrade of in-service assets.

This approach is favoured by all nations, including the most affluent ones. Fighters and fighter bombers are employed for 20 years and more, undergoing two or three upgrades. What is modernisation of an aircraft? This is essentially another step to development of a new asset, the fifth-generation aircraft.

Our aircraft were manufactured 13 or 14 years ago and entered the inventory in the late 1980s and early 1990s. Can these assets be considered obsolete ones? I don't think so. Airframes and engines of Russian aircraft are inferior to none. Our planes have more than once astounded visitors to various air shows. As for the avionics used on in-service Su-27s and MiG-29s, it has grown obsolete, of course. The equipment was developed in the late 1970s, so it does not satisfy modern requirements.

That is why fitting Air Force aircraft with cutting-edge avionics and advanced munitions is the principal objective of the Air Force development program. What makes it more important, modernisation of one aircraft costs less



One of the first Su-24M tactical bombers upgraded last year prior to its flight to a firing range for test launches

than a new fighter, even if the latter is a fourth-generation asset.

On the other hand, merging the Air Force and Air Defence troops into a single branch in 1998 resulted in a fleet of surplus aircraft. To scrap the assets would be a crime. Having upgraded the aircraft, we can export them to foreign customers and get revenues that would later be used for modernising the in-service inventory of the Air Force. By the way, we are currently engaged in negotiations with aircraft developers and producers. We intend to provide them with the surplus assets that are to be subsequently upgraded and sold abroad. The enterprises, for their part, will have to dispatch to the Air Force a certain number of new 4+ generation fighter similar to those exported to China and India.

Due to financial constraints, in recent years the Air Force has been unable to procure new aircraft equal in their capabilities to the export Su-30MK fighters. Yet things are not so bad as they seem to be. Komsomolsk-on-Amur and Irkutsk-based plants have retained their production capabilities, and this is what matters. The enterprises can produce advanced aircraft for the Air Force as well, no preliminary production preparations required. Both companies boast skilled personnel and have all the necessary equipment. We are talking of 4+ generation

aircraft. As early as in 2003 the Russian Air Force will field upgraded Su-27SM fighters that are equal and in some aspects superior to Su-30MK aircraft.

There is another rationale behind upgrade of airborne assets. Modernisation will enable us to test avionics and armament designed for fifth-generation aircraft, which will greatly reduce terms of new assets' development. 4+ generation platforms will be used to try new guidance and navigation systems, radars, strike assets and other equipment. This should be taken into consideration, too.

Q: Versatility is much talked about now. Does this mean the Air Force will have a single advanced combat aircraft used as a fighter and a strike asset?



A: MiG-29 fighters in service with the Russian Air Force can be employed as interceptors and ground attack means. Similar capabilities of upgraded Su-27 fighters will be enhanced through employment of new avionics and air-to-surface guided munitions. Such versatility will be typical of new derivatives of the aircraft, i.e. Su-30MK, Su-35, MiG-29SMT fighters, etc. Much has been talked about more specialised versatility of airborne assets, which will have a most dramatic effect on the fifth-generation aircraft. If we attain the objective, the total number of in-service assets will be further reduced without detriment to the Air Force's capabilities. In short, versatility will enable us to achieve greater goals with less expense.

On the other hand, we should always act within bounds of reason, trying to avoid reverse extremes. Transition to military aircraft's versatility should not affect combat missions.

The Russian Air Force Command do not think that all efforts of the branch should be concentrated on the program of developing one multirole platform. To make the idea more understandable, I would say that everybody cannot ride Mercedes-Benzes – that will be too expensive and unfeasible. We should have lighter and less expensive machines than foreign-made assets. It is more efficient to train pilots on such aircraft. For instance, in Finland 75% of training



Prototype with side No 305 earlier known as the Su-30KI has been undergoing trials since early 2003 as part of the in-service Su-27 aircraft upgrade programme

time accounts for flying light aircraft fitted with equipment of heavy platforms.

Last year we managed to considerably increase the number of flight hours logged by Russian pilots per year. This has been attained through extensive employment of L-39 trainers. In this regard I would like to mention some figures. Forty flight hours on an L-39 aircraft will require 70t of fuel. The same amount of kerosene will suffice for no more than ten flights on a Su-27 fighter, their overall duration mounting up to ten hours. These indexes are out of comparison, that is why much attention is now being paid to the program of developing

the prospective Yak-130 light trainer. Production of the first batch of four aircraft has already been launched by the Sokol Aircraft-building Plant based in the city of Nizhny Novgorod. Trials of the assets have been scheduled for the current year. Yak-130-type aircraft can be efficiently used for training pilots of heavier and, therefore, more expensive fighters, i.e. Su-27s and MiG-29s, etc, and subsequently new-generation aircraft. The new trainers can also be employed as the baseline version for developing a future light strike plane that would be most efficient in local armed conflicts.

Many aircraft of previous generations have been grounded and are now regarded as the Russian Air Force's reserve. Photo: MiG-23MLD and MiG-23UB fighters at a storage base





MiG-25RBT high-altitude high-speed reconnaissance aircraft getting ready for a flight. Containers with aerial cameras are under the open hatch in the nose section of the fuselage. Photo on the right: a MiG-25RBF ELINT aircraft

Q: What is the Air Force Command's concept of the Russian sixth-generation aircraft? Is it going to be a piloted asset of conventional type or an unmanned aircraft that seems to be so popular with foreign experts?

A: Attempts to wage a war by pressing buttons have been made for quite some time, yet none of these have been a success. Automatic systems operate according to pre-determined algorithms that can be deciphered by enemy experts. Remotely controlled assets are vulnerable to interferences of various kinds. The trend of weapons' development proves most convincingly that the tendency is not likely to decline in the future. Only a pilot flying over a battlefield is capable of taking unconventional decisions that will ensure successful outcome of the operation. This is possible due to human ability to think both logically and associatively.

On the other hand, there is a whole range of missions that can be effectively performed by unmanned assets. These include destruction of air defence systems, above all, as well as engagement of stationary ground and sea-based targets. Drones will enable us to minimise human losses, that is why we are going to develop a balanced system of combat assets featuring both manned and unmanned aircraft.

The Air Force is, as you might probably know, the general customer of military airborne

systems to be employed by all services of the Russian armed forces, unmanned assets being no exception. A whole range of unmanned air vehicles (UAVs) now in service with the Air Force and Land Forces has been developed recently on order of the Air Force. Some of the assets have been efficiently employed in the course of the anti-terrorist operation in the North Caucasus and got much acclaim. Enterprises of the Russian Defence industry are now developing a new generation of UAVs, short- and medium-range systems, above all. Apart from that, some companies are ready to manufacture unmanned reconnaissance assets that would ensure overall control over operational environment.

Q: What is the principal trend of transport aviation's development?

A: The fleet operated by the Russian Military Transportation Aviation includes An-124 and An-22 strategic military airlifters, Il-72MD and An-12 intra-theatre aircraft, An-26 and An-72 tactical cargo planes. Service lives of An-22 drawing to an end, they will soon be removed from the Air Force inventory. An-12s and An-26s will be phased out, too. To satisfy modern standards, Il-76MD and An-124 aircraft are to be upgraded in the near future. All this means that the fleet of cargo aviation will

undergo crucial changes in the years to come.

Type variety of the aircraft will be minimised. There is going to be one type of heavy strategic transportation aircraft, its carrying capacity mounting up to 120t. The Ruslan An-124 transportation plane will be used as a means of the type. In-service Ruslans have been slated for upgrade to the An-124-100 standard.

Intra-theatre airlift of cargoes ranging from 30 to 40t is performed by Il-76MDs. In short-term prospect the aircraft will remain to be the principal asset of the type, yet the new noise-reduction standards necessitate its refitting with PS-90A-76 engines. Apart from that, the Russian Air Force needs the upgraded version of the Il-76 airlifter featuring a similar powerplant and an extended fuselage. The new aircraft referred to as the Il-76MF has a lifting capacity of up to 50t. The problem is that mass-production of the asset was to have been launched in the city of Tashkent that is now outside the boundaries of our country. We are now considering the prospect for manufacturing Il-76MFs in Voronezh. In addition to that, we are going to buy several aircraft of the type from Uzbekistan.

The question of substituting An-12s and, partially, Il-76s with future An-70 Russo-Ukrainian aircraft is a most complicated matter. The only prototype of the new aircraft is undergoing trials now, a great deal of various deficiencies already detected. The Russian Air Force is not satisfied with the powerplant employed on the airlifter as far as its noise-level is concerned, and not only that. In the future the Air Force Command is ready to revise its stance towards buying An-70s, provided developers of the aircraft have introduced substantial changes to the plane's design and completed a full cycle of trials. In addition to that, Russia has a project of her own, its principal objective being development of the similar-type Tu-330VT aircraft greatly commonised with mass-produced

Su-24MR dedicated reconnaissance aircraft in service with the Separate Guard Reconnaissance Regiment taking off from the Shatalovo airfield on a training mission



Tu-204 and Tu-214 passenger planes. Production of the airlifter by the Kazan-based plant might cost less than manufacture of the An-70 in the city of Omsk.

Supplanting An-26 tactical transportation aircraft will be one of the most pressing issues in the near future. Realisation of the problem has led the Russian Air Force to announcing a tender for a prospective tactical cargo plane with carrying capacity ranging from 5 to 6t. Of all the participants the most probable winners will be Ilyushin with the Il-112V and RAC MiG with the MiG-110. The results of the tender are likely to be known by the year end. Following this, the winner will launch a full-scale development of the aircraft, certification trials to be completed in 2008.

Q: It is universally known that efficiency of combat aircraft's employment is determined by the assets' capabilities and, to a great extent, by professional facilities of the operators. Prospective systems will be employed by new-generation pilots. What is the situation in the Air Force in regard to training flight personnel?

A: Due to substantial reduction in the Russian Air Force's fleet and personnel, a great number of Air Force colleges are no longer cost-effective. That is why in 2001 work on forming a unified Air Force college was launched, the project completed in 2002. The institution in question is the Krasnodar Air Force Institute comprising three flight centres – the fighter aviation centre in the town of Armavir, the transportation and long-range aviation centre in the town of Balashovo and the tactical strike aviation centre in the town of Borisoglebsk. All the training facilities required for quality training pilot cadets have been retained. Term of education lasts five years, yet in the near future it might be reduced down to 4.5 years. Cadets spend the first three years of their training in the city of Krasnodar. Following this, with due consideration for the future pilots' personal qualities and capabilities, students are streamed into three classes to be subsequently sent to three different centres. The new system minimises attrition of senior cadets, adding to the flexibility of the military education system.

The Russian Air Force Command have every ground to believe that the new generation of Russia's military pilots will in due course inherit glorious traditions of their senior colleagues. Just as it has always been, the national Air Force with skilled personnel and cutting-edge assets will be at any moment ready to defend the country, acting on orders of the Commander-in-Chief and Russia's higher military command.

Vladimir BEKHTER,
Russian Air Force Press Service



REFERENCE INFORMATION

RUSSIAN MILITARY AVIATION COMPOSITION IN 2002

(based on the Military Balance annual bulletin, published by the London-based International Institute for Strategic Studies)

AIR FORCE

Long-range aviation (the 37th Air Army of the Supreme Strategic Command)	
Long-range strategic bombers	78
Tu-160	15
Tu-95MS	63
Long-range bombers	125
Tu-22M3	125
Air tankers	20
Il-78	20
Trainers	30
Tu-134UBL	30

Military transport aviation (the 61st Air Army)	
Military transports	260
An-124	15
An-22	26
Il-76M/MD	220

Tactical aviation (the 4th, 6th, 11th, 14th, and 16th Air Armies)	
Tactical bombers and attack aircraft	600
Su-24M	370
Su-25	230
Fighters	900
MiG-29	250
Su-27	390
MiG-31	260
Reconnaissance aircraft	210
MiG-25RB	70
Su-24MR	140
AWACS aircraft	20
A-50	20
EW aircraft	60
Mi-8	60
Fixed- and rotary-wing transports	...
An-12, An-26, An-72, Mi-8	...

Naval aviation

Long-range naval bombers	40
Tu-22M3	40
Bombers and attack aircraft	50
Su-24M	50
Fighters	80
Su-33, Su-27UB	24
Su-27	28
MiG-31	30
Trainers	10
Su-25UTG	10
ASW aircraft	50
Tu-142M	20
Il-38	26
Be-12	4
EW aircraft	30
An-12PPS	20
Mi-8	10
Fixed- and rotary-wing transports	40
An-12, An-24, An-26, An-72	40
Mi-8	...
ASW, SAR, and combat transport helicopters	100
Ka-27, Ka-27PS	70
Ka-29	12
Mi-14	3
Mi-24	15

Army aviation

(organic to the Air Force as of 1 January 2003)

Helicopters	about 1,100
Mi-24	about 500
Ka-50	6
Mi-8	about 530
Mi-26	about 50

Note

- Besides the figures, given above, the Air Force Combat Employment and Flight Personnel Conversion Training Centres operate another 140 combat aircraft (36 MiG-29s, 10 Su-27s, 50 Su-24s, and 25 Su-25s).
- Flight schools operate about 980 L-39, Tu-134, MiG-23, MiG-29, Su-25, and Su-27 trainers, as well as Mi-8, and Mi-24 helicopters.
- Up to 1,500 medium- and long-haul passenger airliners and air freighters, including about 350 An-12s and Il-76s, constitute the military airlift reserve.
- The Federal Border Guard Service aviation operates around 70 Il-76, Tu-134, An-72, An-24, An-26, and Yak-40 aircraft, and in excess of 200 Mi-8, Mi-24, Mi-26, and Ka-27 helicopters.

Kazan Helicopters boasts more than 60 years of glorious history. Founded in 1940, the plant began its operation with manufacture of Po-2 light biplanes. In the early 1950s it became the ground-breaker in helicopter-building industry. The Mi-1 helicopter was the first rotary-wing aircraft produced by the enterprise. It was followed by the Mi-4 multi-seat aircraft that subsequently became the backbone of helicopter fleet in the USSR and abroad. The acclaimed Mi-8 was put into mass production in 1965; some time later the enterprise started manufacture of the Mi-14 amphibious derivative, and other versions as well. Wealth of experience has been gained



ROTORCRAFT BY KAZAN HELICOPTERS

by the plant in 50 years of its operation; there is no doubt that the company now enjoys the status of the world's leading helicopter producer. Along with comprehensive improvement of mass-produced assets, experts of the plant have been engaged in designing new types of rotary-wing aircraft. The enterprise became Russia's first helicopter-building company to have a design bureau of its own.

Production efforts of the Kazan plant are currently concentrated on building the Mi-8/Mi-17 medium multipurpose helicopter. The overall

number of Kazan-built aircraft is over 7,500 helicopters produced in more than 100 versions. Over 3,500 aircraft of the type have been exported to more than 80 countries all over the world. A special mention should be made of the helicopters' unique survivability and operational reliability. The ever-growing popularity of the aircraft, as well as its extensive employment, has been caused by the uninterrupted modernization of the asset. Sterling expertise gained by experts of the plant in the course of the helicopter's employment has enabled them in col-

laboration with designers of the Mil Moscow Helicopter Plant to increase reliability and survivability of the aircraft, improve its manoeuvrability and flight characteristics, and facilitate servicing and maintenance procedures.

Among the baseline versions mass-produced by the Kazan plant are the Mi-17V-5 (Mi-8MTV-5) multipurpose helicopter and Mi-172 civil aircraft certified in India. The Mi-17V-5 differs from its predecessors in streamlined outlines of the fuselage and improved framework design. Apart from that, the aircraft features a modified nose section, starboard access hatch, port side hatch considerably enhanced. Rear cargo clamshell doors have been substituted with a hydraulically-driven ramp. The number of transported personnel has been increased to 36 men. The Mi-17V-5 aircraft is fitted with a recovery system and external cargo sling of enhanced carrying capacity. It also has an upgraded navigation system and is adapted for use of night vision goggles. Other units and assemblies have been substantially changed, too, making provision for additional navigation equipment, energy-absorbing pilot seats, parachuteless ejection systems, BAMBI-type fire-fighting systems, other types of Russian and foreign-made equipment.

The Mi-172 can provide comfortable transportation to 26 passengers. The passenger cabin is fitted with emergency exit hatches and ejectable rectangular windows satisfying international safety standards. In addition to that, the aircraft features an emergency water landing system ensuring the helicopter's floating capabilities for at least 30 minutes, which is



quite enough for evacuating all the passengers.

In 1995 the Kazan plant acting in close co-operation with the Kelowna Flightcraft Company, Canada, started fitting the Mi-172 aircraft with avionics produced by the US leaders in the industry, specifically, Honeywell, Collins, BF Goodrich, etc. The project that turned out to be a success enabled the Kazan company to enter the much-promising South Korean market. The first helicopter of the type was procured by South Korean police that now employs it as an anti-terror asset. To increase flight safety at low altitudes the helicopter is equipped with a wire-collision avoidance system.

The year 2001 saw the start of flight trials of the Mi-17's new version featuring more efficient VK-2500 engines and the new SAFIR-5K/G aux-

iliary power plant, as well as to perform some missions of heavier Mi-6 and Mi-10 aircraft. The Mi-38 program is one of the largest helicopter-building projects in the world that, among other things, can be justly regarded a conspicuous example of dynamic international cooperation in Russia's aircraft-building industry.

According to expert assessment, substantial upgrade of Mi-17 helicopters and development of the advanced Mi-38 aircraft will result in appearance of two baseline assets with extensive upgrade potential. The new helicopter will ensure long-standing demand for the company's products and full employment of its production facilities in the first quarter of the 21st century. Despite the fact, the enterprise is now aggressively engaged in attempts to diversify

this, no doubt, will ensure high competitiveness of Russian-made helicopters in regard to both cost and capabilities.

Currently several prototypes of Ansat are being certified at the Kazan plant. One of the aircraft has been ground-tested for 800 hours. The second prototype, its maiden flight made on 17 August 1999, has flown for over 150 hours. The third Ansat has logged more than 50 hours, its trials launched in late 2001.

The lighter prospective version of the helicopter is referred to as Aktai, which in Tartar stands for a white colt. This little multipurpose three-seat aircraft is powered by the VAZ-4265 radial plunger engine. Employment of the new engine along with balanced introduction of traditional and novel approaches will maximise the helicopter's competitiveness on international



iliary power plant; the enhanced capabilities of the helicopter enable it to take off from pads at altitudes of up to 6,000m.

The ultimate objective of the 2-3 year project now being pursued by Kazan Helicopters in co-operation with the Mil Moscow Helicopter Plant, some other Russian and foreign enterprises, provides for development of a new baseline version on the basis of the Mi-17 aircraft. The new helicopter will be fitted with improved rotor blades made of composite materials, X-shaped tail rotor, other assets, including glass cockpit-type avionics suite enabling two-pilot complement of the crew and automatic mode operation. The new aircraft will have improved performance and new maintenance capabilities.

Comprehensive upgrade of venerable Mi-8s is carried out in parallel with development of an entirely new baseline version designated as the Mi-38. The new helicopter will be used to renew

the inventory of produced assets. Market studies proved the great promise of multipurpose and specialised rotary-wing aircraft lighter than Mi-17 helicopters. It is worth noting that the design bureau of the Kazan plant was set up in 1993 specifically for the purpose. Within the initial stage of the project the enterprise in collaboration with other companies of Russia's aircraft-building industry is developing two new helicopters, their take-off weights mounting up to 3,300 and 1,300kg. The largest portion of finances comes from the company's inner reserves gained through export sales of Mi-17 aircraft.

The 3,300kg helicopter was designated as Ansat, Tartar for comfortable. The name of the aircraft determined its concept. Designers of the asset strived to achieve a delicate balance between traditional and unconventional approaches, materials and technologies, and

market. Designers of the aircraft that, in fact, is unusually light as compared to similar-type Russian assets, intend to attain superb flight and maintenance performance.

Taking into consideration the experience of the company's experts in upgrading Mi-4, Mi-14 and Mi-8/Mi-17 aircraft, totally some 200 versions, one might expect success of similar operations in regard to baseline Ansat and Aktai helicopters. Coupled with assets produced by other helicopter-building enterprises in Russia, the new products of the Kazan plant will enable the national industry to fill in all the gaps on the international helicopter market. Untarnished reputation of the aircraft, as well as strong relations of the plant with trade partners all over the world will ensure great demand for Kazan-built helicopters both in Russia and abroad.

Vadim MIKHEYEV

KAMOV HELICOPTERS:

RELIABLE SOLUTION TO YOUR PROBLEMS



Ka-31



Coaxial design of rotary-wing aircraft has been for many years favoured by helicopter designers all over the world, its advantages only too obvious. The principal benefit of the concept is that the entire output of the power plant is transferred into the rotors' thrust, which ensures aerodynamic balance of the aircraft and greatly facilitates its technical piloting in comparison with helicopters of conventional design. In addition to it, blades rotating in opposite directions by some 15-20 per cent increase the aircraft's thrust-to-weight ratio, improve its manoeuvrability and flight safety characteristics, which is crucial for ship-based helicopters operating from small-size take-off and landing pads surrounded by deck structures.

In contrast with their conventional counterparts, Kamov helicopters are less vulnerable to wind direction and velocity; they are also highly resistible to strong turbulent flows and gusty winds, which ensures uninterrupted operation of the asset in adverse weather conditions 24 hours a day. The aforementioned characteristics, along with superb corrosion resistance vitally important in aggressive marine environment, have enabled the Kamov company to develop a whole family of ship-borne rotary-wing aircraft, among them Ka-25s, Ka-27s, Ka-28s, Ka-29s, and Ka-31s, taking in all the aspects of naval helicopters' employment.

The Ka-31 radar picket helicopter is used to detect airborne targets flying below the aircraft's altitude, and reconnoitre water-surface situation, relative data automatically transferred to the command post. Helicopters of the type are operated on monitoring and reconnaissance, command and control missions in the interests of Coast Guard, Navy, Border Guard Service and other state bodies. The avionics suite noted for its efficiency is based on the cutting-edge high-performance radar system fitted with a 360-deg. rotating antenna. The equipment of the aircraft enables it to automatically detect, identify and track up to 40 targets, as well as to determine their flight pattern. The helicopter boasts a unique design accounting for the special status of the Ka-31 among its ship-borne and ground-based counterparts. Several Ka-31s are capable of providing effective support to a battle group of surface ships, detection of small-size low-altitude targets, such as cruise missiles, included.

Recent years have seen the Kamov company diversify the range of its products, manufacture of Army helicopters being an effective advertisement for the trend.

Ka-32 rotary-wing aircraft developed on the basis of ship-borne Ka-27 helicopters are used as civil aviation assets in several versions, specifically, as transportation, fire fighting,

search and rescue, police, mountain, etc., helicopters. The Ka-32A11BC fire fighting aircraft, unmatched in its class, has been certified in Canada to FAR-29 and FAR-33 standards.

The universally-known Ka-50 Black Shark helicopter has been in service with the Russian Army since 1995. A two-seat version of the aircraft, designated as the Ka-52 Alligator, has already been built.

The new-generation Ka-52 all-weather gunship is used to destroy ground-based armoured targets, low-altitude airborne targets and hostile manpower on the frontline and beyond into the enemy's territory acting as a tactical asset. Its mission provides for reconnaissance support to friendly units and coordination of strike helicopters' operation. The aircraft is fitted with an advanced high-precision armament and navigation suite, signature-reduction equipment, ECCM and active jamming systems. The most important units of Ka-52 helicopters are made redundant and well-protected. In addition to that, the aircraft features an armoured cockpit

and a jettison chute ejection system. The air-tight cockpit is NBC resistant. On the international market the Ka-52 aircraft competes successively with Army helicopters of the world's best producers, such as the Apache-Longbow, King Cobra, Tiger, etc.

The Kamov company was the first to produce a single-rotor helicopter designated as the Ka-60. The aircraft is capable of airlifting 14 troops, its cruise speed mounting up to 300km/h. The asset is noted for its superb operational and design reliability. Manufactured of composite materials, the helicopter satisfies international standards applied to reliability, service life, flight safety, comfort and maintenance characteristics.

The Ka-226 aircraft is a light multipurpose helicopter with interchangeable transportation modules. A variety of payload modules ensures



Ka-60



Ka-226

high operational efficiency of the asset and its superb economical performance. Apart from that, the modules enable the aircraft's operators to employ one helicopter as a cargo and passenger transportation asset, training, liaison and control aircraft capable of carrying out relief operations, patrol, fire fighting and medevac missions. The Ka-226 is noted for ease of operation, low noise level, high flight safety characteristics, and excellent maintainability. It is fitted with foreign-made engines, cutting-edge navigation and radio equipment, rotor blade de-icing system, air conditioning unit, and other assets. The baseline version of the helicopter can be refitted into any other variant by two experts within several hours. The design of the heli-

copter satisfies corresponding Russian and international standards applied to operational reliability, service life, flight safety, comfort and maintenance characteristics. The helicopter has been certified to AP-29 and FAR-29 airworthiness standards as an A and B Class transportation asset capable of visual and blind flights in adverse weather conditions 24 hours a day.

The Kamov company provides its customers with follow-on supervision and comprehensive maintenance support within terms of employment of the aircraft.

Kamov helicopters are now extensively used by many military and civil operators in countries all over the world, including Canada, Switzerland, Spain, China, India, South Korea, Taiwan, and other nations.



Ka-52



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OPTRONIC TARGET TRACKING SYSTEMS FOR SAMs

Recent combat operations, which have seen massive employment of air attack assets, including small-size unmanned aerial vehicles (UAV), which in turn widely use anti-radiation missiles and ECM systems, proved the necessity to employ other than active radars target tracking systems.

Passive optronic target detection and tracking systems are one of the many options. Systems like that facilitate the required covertness and quite a high accuracy. Besides, optronic systems feature smaller weight and dimensions, while their detection range is similar to that of active radars. Infra-red devices enable optronic systems to operate by day and night, and most of the time in any weather conditions. Another advantage of infra-red target tracking systems consists in the fact that they can only be jammed by a jamming source, situated within the field of view, which is quite limited (only several degrees). This fact increases radar immunity of systems like that.

Since air attack systems can operate both at high altitudes (over 10 km) and extremely low altitudes (5-15 m), target tracking systems are to have a great maximum detection range of up to 10 km, on one hand, and quite a short minimum range, on the other hand.

An increase in the maximum detection range results in larger entrance pupils of optronic systems, and, thus, greater weight and dimensions. A shorter minimum range requires higher dynamic capabilities of servo drives, however greater weight interferes with that. Thus, even on the face of it, the task of developing an optronic target tracking system was torn by internal contradictions.

In the optronic target tracking system of the Pantsir-S1 theatre air defence system the aforementioned contradictions have been settled as follows. When tracking the target, the optronic system defines its coordinates, even when the platform proper is on the move, and simultaneously defines coordinates of the own missile and feeds command signals to it. These tasks are discharged by the optronic target tracking system, the infra-red direction finder, and the command signals transmitter. A thermal imaging device and an optronic sensor are used as optronic receivers in the target tracking system and the infra-red direction finder respectively.

Optronic receivers and the command signals transmitter aerial are mounted on a common platform. As the missile is guided to the target by aligning the target line of sight and that of the missile, optronic sensors are turned



towards the target on coordinates data, transmitted by the optronic target tracking system, or in compliance with external target designation.

Taking into account a convenient layout and a minimum number of servo power drives, a two-axel gimbal with a rotating azimuthal plane and a rocking elevation plane was designed to move the platform, mounting optronic devices.

The rotating and the rocking parts of the gimbal are activated by an automatic electric power drive. The servo drive without the reduction gear, based on a torque engine, allowed the rigidity of the mechanical system to be considerably increased, while the kinematical errors of the transmission gear to be reduced. The tachometer generator and the angle-data transmitter, integrated into the engine, allowed the error of measuring the angular velocity and the engine shaft movement to be reduced, as well as provided high rigidity in the engine-tachometer generator, engine-transformer chains.

The two-coordinate drive with three feedback circuits (current, angular velocity, and angle) was based on these engines, which provided high accuracy at good tracking smoothness of the incoming signal. Both operator-generated and automatic data is used to generate an incoming signal, corresponding to the target's movements.

Given the fact that the optronic system is operated when the platform is on the move, it is affected by oscillations. The gyro angle-data transmitter and sensors of the angular velocity

and angular acceleration unit are used to measure the oscillations in question. It can also used oscillations data, transmitted by the navigation system of the theatre air defence system.

The TV device features the electronic image stabilisation in order to improve its operation and facilitate accumulation of video signal. The stabilisation is carried out in the digital filtering and image shear modules. Output signals of the gyro angle-data transmitter are used as incoming signals for the precision stabilisation channel.

A display, based on the liquid-state matrix (a panel with a diagonal of 46 cm), is used to visually observe the tracking process.

The infra-red direction finder, which consists of the following two units: the optronic sensor and the coordinates detection unit, is used to increase radar immunity when guiding the missile to the target. The optronic sensor converts the optical signal, transmitted by the missile, into an electric signal, proportional to the missile's deviation from the optical axis of the optronic sensor. The optronic sensor has two channels. One of them is designed to define coordinates of the continuous radiation source, while the other one is designed to define coordinates of the pulse radiation source. The former is used to acquire and track the missile after the launch by its blast, as well as to track missiles, fitted with a flare as the airborne transponder. The latter is designed to detect missiles, fitted with a pulse transponder. The pulse channel of the infra-red direction finder is

synchronised with the command signals transmitter in order to increase the dynamic stability of the missile control loop.

Both channels employ moving optical components. Signals on the image position with respect to the photodetector are used to control their drives. In order to increase radar immunity, field of view stops, which limit the field of view, are inserted into tracking channels, when the intermediate process is over.

The coordinates detection unit of the infra-red direction finder discharges the following operations: source coordinates are defined with respect to the centre of a corresponding photodetector, optical component drive control signal is corrected and amplified, the range to the missile is defined, and data is exchanged with various subsystems of the air defence system. Complete coordinates of the missile's line of sight with respect to the optical axis of the optronic sensor are calculated by the central computer.

When the platform is on the move, the operation of the infra-red direction finder is provided by offset signals, proportional to system errors, measured by the gyro angle-data transmitter.

The command signals transmitter sends signals to the missile and detects the range to the missile. The employment of both optical and

radar channels for detecting the range allows the reliability of getting this figure to be increased, and the range errors to be reduced.

The optronic system features channel adjustment, designed to improve the missile guidance accuracy using the difference of coordinates, transmitted by the optronic target tracking system and the infra-red direction finder. Adjustment results are stored in the central processing unit.

Radar immunity of the optronic system is achieved with the help of the correlation processing algorithm in the TV device, gating the field of view when tracking the target and automatically acquiring the target by the outline in the tracking gate, introducing the ban on automatic acquisition of images of own missiles by the target tracking channel, based on their coordinates in the field of view of the TV device, transmitted by the central computer, inertial target tracking, using extrapolated coordinates, when there is no optical communications with the target (when the target is behind a jamming cover), the semi-automatic target tracking, carried out by the operator, in heavy jamming, to differed frequency channels, employed by the optronic sensor, spectral selection in optical channels of the optronic sensor, space selection of the missile image, introducing field of view stops to the optronic sensor when tracking the

target in the automatic mode, temporary selection by gating the signal from the airborne transponder of the own missile, when the signal is received, taking into account real and calculated range to the missile and its speed, electric spectral selection in the processing section of video signals, transmitted by photodetectors of the optronic sensor, in order to suppress pulse jamming, the curtain for protecting photodetectors of the optronic sensor from being exposure to light, radio signals scrambling, quasi-random transmitter frequency selection with the help of software-generated deviation of the own missiles from the target's line of sight.

Thus, the optronic system with infra-red target and missile tracking channels may operate by day and night and provides target detection and tracking ranges, comparable to that of radar systems, featuring similar dimensions, at a higher accuracy. All the facts, mentioned above, as well as the considerably lower cost of the optronic target tracking system, as compared to that of a radar with the same detection range, makes it a very promising option to be integrated into fire control systems of air defence systems, especially given massive employment of ECM means.

**Valery FIMUSHKIN, Boris GRYAZEV,
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Optronic system

Purpose

Additional target detection on data from target designation systems

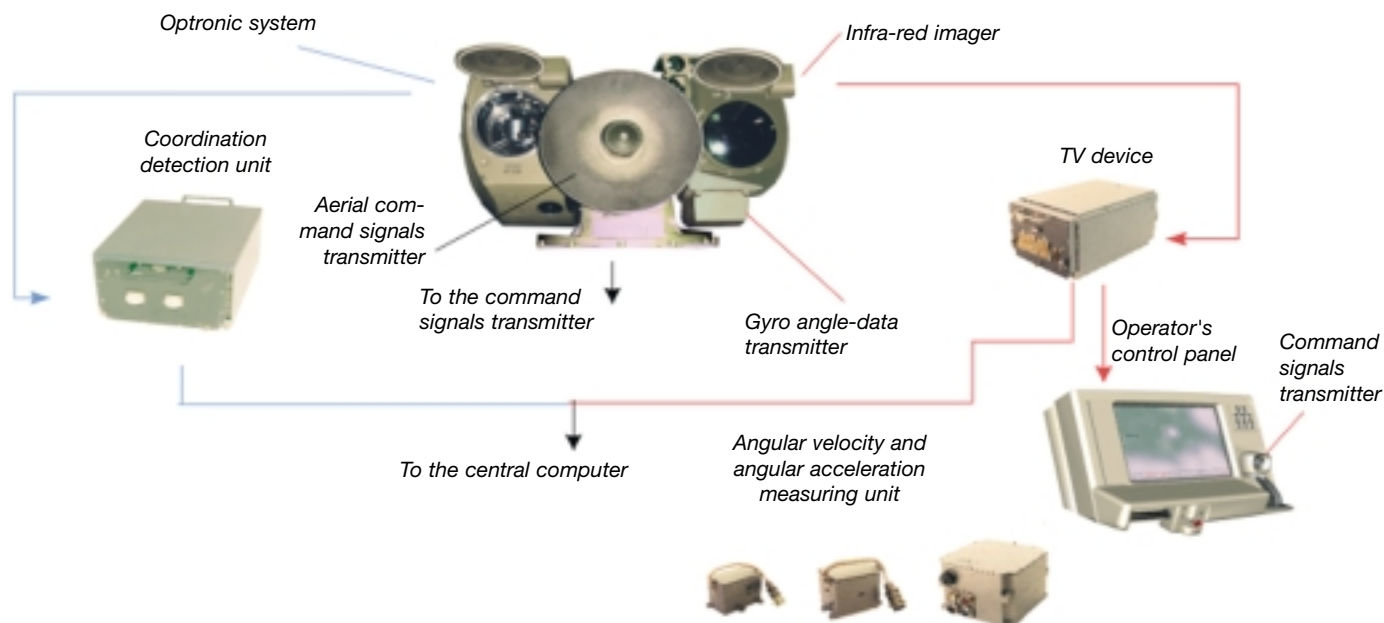
Automatic acquisition and tracking of up to two targets throughout the field of view of the IR thermal imager

SAM site coordinates detection

Transmitting control signals to the missile

Missile infra-red direction finder

Thermal imaging channel



RUSSIA'S AIR TRANSPORTATION MUSHROOMING, THOUGH PROBLEMS PERSIST

According to Aleksandr Neradko, head of the Russian State Civil Aviation Service (GSGA) and Deputy Minister of Transportation, the passenger air traffic in Russia in 2002 increased by 5.8 per cent as compared to that of the previous year. In 2001 civil aviation carried 25.07 million passengers, while in 2002 it transported 26.52 million people. Mr. Neradko was quoted as saying that air traffic seemed to have increased both on domestic and international routes.

"The increase in domestic air traffic may well be explained by the fact that the national economy is getting back on track. In addition to that in 2002 air fare rose by only 14 per cent, which is quite comparable to the internal inflation rates", said head of GSGA. He also expects further increase in both domestic and international passenger air traffic in 2003.

In 2002 the international component of the passenger and freight air transportation market saw the most intensive development. The share of international air traffic totalled 49.8 per cent in the passenger niche, and 68.2 per cent in the freight one. 16-18 per cent of the total number of passenger flights and up to 30 per cent of the overall freight air traffic account for operations to industrialised countries.

LOTS OF AIRCRAFT TO FLY SO FAR, BUT SITUATION IS BOUND TO REVERSE

At the present time the Russian Civil Aircraft Register lists 3,983 fixed-wing aircraft (31 types), and 1,915 rotary-wing aircraft (eight types).

The existing fleet is capable of handling the present volume of air traffic. However, given forecasts for scrapping aircraft when their service life expires, there will have been 4,800 aircraft left in service by 2005 (a 20 per cent reduction), while by 2010 the aircraft fleet will have been reduced by 50 per cent.

Current air transportation capabilities inherent in the airliner fleet will have reduced by 20 per cent by 2005, and by 50 per cent by 2010. At the same time the number of Il-62Ms and Tu-154Bs will have been halved by 2006. Transportation capabilities of regional aircraft, which are expected to be reduced by 50 per cent by as early as 2005, will sustain the most drastic impact.

The existing air transportation capabilities of air freighters will have decreased by 20 per



Aleksandr Neradko: "The increase in domestic air traffic may well be explained by the fact that the national economy is getting back on track".

cent by 2005, and by 40 per cent by 2010, while those of the helicopter fleet are expected to be reduced by 35 per cent by 2005, and by 60 per cent by 2010. All existing Il-62s, Tu-154Bs, Tu-134s, An-24s, Yak-40s, An-28s, An-12s, An-26s, and Mi-10s are expected to be scrapped by 2010.

However, even at present most aircraft in service with the Russian civil aviation are morally obsolete and do not meet international requirements, in particular, the European standards. Most of the aforementioned aircraft had been manufactured by the early 1990s and are facing service life limitations, problems with respect to spare parts, and demand much spending to stay operational.

The aircraft in question need replacing with new-generation machines. Given the predictions, mentioned above, the Russian aircraft fleet will have to be equipped with about 200 additional airliners and 300 regional aircraft, as well as 80 air freighters, and 350 helicopters by 2010.

At the moment Russia operates a total of 22 new-generation aircraft (11 Il-96-300s, eight Tu-204s, and three Tu-214s). Besides, there are also 52 Western fixed- and rotary-wing aircraft, including 39 airliners.



HE IS LIFELESS WHO IS FAULTLESS

In 2002 Russia suffered 21 air crashes, including seven accidents, which caused 131 deaths. Besides air crashes, 985 incidents and 66 ground accidents were registered in 2002 (for the sake of comparison: in 2001 Russia experienced 1,015 incidents and 55 ground accidents).

The number of casualties in 2002 was by far smaller than in 2001, when 218 people were killed in ten air crashes. However, according to Mr. Neradko, in some cases local civil aviation authorities fail to provide efficient flight safety and take firm measures against air carriers that regularly break flight safety rules.

TERRORISTS STILL AT LARGE

The Russian Civil Aviation Security Service inspected 26 million passengers in 2002. The pre-flight customs inspections resulted in unearthing in excess of 55,000 occasions, when passengers tried to take along prohibited hazardous items. As many as 6,500 arms, 47,200 ammo, 217kg of explosives, nine tons of flammables, and 3.4t of toxic agents were impounded.

The Russian Civil Aviation Security Service certified 29 airports and air carriers, six freight terminals, as well as 13 types of technical inspection means. The year of 2002 saw 240 training exercises under the Nabat programme. Russia earmarked RR139 million (just under \$4.5 million) for fulfilling her international commitments with respect to flight safety.

However, hijacking aircraft and using them as a means of destruction still poses a real threat. Any terrorist attack threats against aircraft and aviation facilities also inflict severe financial and moral damage on the Russian civil aviation.

NOISE LEVEL REMAINS INTACT

Noise abatement requirements, introduced on 1 April 2002, resulted in taking all Il-86s, Tu-134s, Il-76s, Il-62s, and Tu-154Bs off international flights in 2002, while the aircraft in question account for 50 per cent of the total air traffic of the existing Russian civil aircraft fleet.

Temporary permits, allowing aircraft to fly to Europe in compliance with Chapter 2, expire in 2003. Only 10 per cent of Yak-42s and Il-62Ms, as well as 64 per cent of Tu-154Ms are Chapter 3 compliant.

In September 2003 major European airports are going to start introducing noise restrictions under Chapter 3, according to which aircraft are to have noise level of less than 5 EPN dB. This fact will pose serious problems for Russian air carriers, as only most cutting-edge Russian aircraft such as Tu-204s, Tu-214s, and Il-96-300s, which account for only six per cent of the total air traffic, meet the noise standards set forth in Chapter 3.

The Russian civil aviation is bound to run deficit of aircraft, which meet the afore-mentioned requirements, if it fails to make



Yak-42s and Tu-154Ms less noisy by 2005-2006. Tu-204, Tu-214, and Il-96-300 aircraft, being offered by the national aircraft industry, do not meet requirements set out in Chapter 4.

The Joint Efforts Programme for 2002-2010, aimed at reducing noise and emission levels, and improving navigation accuracy of national fixed- and rotary-wing aircraft in order to meet ICAO and EU standards, has not been adopted so far. The afore-mentioned programme envisages only research and development, whereas current requirement consists in re-engining Tu-154Ms to make them fit in the noise limits. According to experts, the required number of Tu-154Ms, upgraded like that, will have equalled 30-40 by September 2003.



ILLUSORY LEASING

Last year saw completion of the bid among leasing companies, won by Ilyushin Finance Co. and the Financial Leasing Company, which was aimed at securing state support.

However, despite this fact, in 2002 aircraft-building enterprises did not get the money for mass production of new aircraft, envisioned by leasing projects. Only five Russian air carriers received about RR98 million (around \$3 million) late last year out of the total RR500 million (about \$15 million) allocated by the government as interest rate offsets for re-equipping the air carriers with new national aircraft. The short-term objective is to restructure tax debts of aircraft-building enterprises into budgets of all levels. At the same time it is of paramount importance to establish strict state

control over leasing companies' spending on production and deliveries of national aircraft.

MISUNDERSTOOD TIME AND AGAIN

A decade into the economic reform, aircraft developers, manufacturers, and operators still lack efficient cooperation enabling them to secure contracts on delivering yet-to-be-built aircraft, with such an approach providing required financial assets. Besides, manufacturers of aircraft components have failed to come up with independent marketing investigations with respect to future aircraft (aircraft components) deliveries and signing firm contracts with aircraft operators.

When operating new-generation aircraft, air carriers frequently face serious challenges, pertaining to keeping aircraft operational.

Establishment of regional aircraft maintenance centres has not made much progress either, which has resulted in the fact that Tu-204s and Tu-214s remain grounded for extended periods of time. Despite comparably high characteristics of Tu-214s, their operation remains unprofitable. Mean time between failures of procured units of the integrated flight and navigation system and the integrated emergency warning system equals only about 15 hours. This does not allow aircraft to regularly carry out non-stop Khabarovsk-Moscow-Khabarovsk flights on a daily basis.

The Main Minimal Equipment Inventory, a list of what an aircraft has to have, has not been introduced so far, and this does not allow the aircraft system redundancy capabilities to be used to a maximum extent. It is a must to set up maintenance and after sales service centres for

Tu-204, Tu-214, and Il-96-300 aircraft in the near future.

There are still occasions of delivering sub-standard spare parts, although a number of air carriers have undergone the unit legitimacy inspection, which resulted in grounding 75 aircraft. When material breaches were unearthed, either certificate of conformance terms were limited (Rus, Voronezhavia, and Ire Aero air carriers), or respective aircraft were grounded.

DO YOU SEE ME? I DON'T

Flight safety improvement rests heavily on fitting aircraft with new avionics to decrease vertical separation requirements and facilitate zone navigation with the help of the traffic collision avoidance system, the ground proximity warning system, and emergency radio beacons, when 8.33 KHz radio stations are employed.

At the present time Russian aircraft are fitted with 435 foreign-made TCAS systems each worth \$200,000. As many as 225 aircraft are

permitted to fly with reduced vertical separation. However, these issues are not the only problems facing civil aviation. In 2004 the requirements, mentioned above, are expected to hold true for aircraft, carrying out domestic flights.

CAN'T DO WITHOUT SIMULATORS

Flight simulators are the main ground-based means for teaching, training, and maintaining professional skills of flight personnel. They also considerably improve flight safety.

REFERENCE INFORMATION

RUSSIAN CIVIL AIRCRAFT FLEET AS OF EARLY 2003

	1 January 2003	1 January 2002
Passenger aircraft		
An-24	250	264
Il-18	19	27
Il-62	69*	76
Il-86	73	73
Il-96-300	11	11
Tu-134	238	235
Tu-154B	174	175
Tu-154M	173	178
Tu-204	13	14
Tu-214	3	1
Yak-40	314	326
Yak-42	81	81
Foreign aircraft	51	46
Total	1,469	1,507
* including six Il-62s and 63 Il-62Ms		
Air freighters		
An-12	76	84
An-26	165	181
An-30	42	44
An-32	11	20
An-74	32	24
An-124	20*	20
Il-76	181**	179
Total	527	552
* including four An-124s, and 16 An-124-100s		
** including 30 Il-76Ts, 110 Il-76TDs, and 41 Il-76MDs		

NEW RUSSIAN AIRCRAFT IN SERVICE WITH NATIONAL AIR CARRIERS

	1 January 2003	1 January 2002
Il-96-300	11	10
Aeroflot	6	6
Domodedovo Airlines	3	3
Rossiya GTK	1	1
Atlant-Soyuz	1	-
Tu-204	8	7
Kavminvodyavia	2	2
KrasAir	2	2
Sibir	2	2
Aerofrakht (Iu-204S)	2	1
Tu-214	2	1
Dalavia	2	1

According to the Russian State Civil Aviation Service report "The Civil Aviation industrial and economic activities results in 2002 in Russia" published in March 2003

	1 January 2003	1 January 2002
General utility airplanes		
An-2	1,815	1,897
An-3	12	-
An-28	35	38
An-38	6	4
Il-103	9	9
Il-114	2	-
L-410UVP, UVP-E	90	98
Yak-18	18	16
Total	1,987	2,062
Helicopters		
Ka-26	64	68
Ka-32	68	75
Mi-2	571	598
Mi-6	30	31
Mi-8	1,110*	1,124
Mi-10K	8	9
Mi-26	55	54
Mi-34C	8	5
Total	1,914	1,964
* including 924 Mi-8Ts, and 186 Mi-8MTs		

FOREIGN AIRCRAFT IN SERVICE WITH NATIONAL AIR CARRIERS (AS OF 1 JANUARY 2003)

Passenger airliners and air freighters	
Boeing 737-200, -300, 400, -700	18 (Aeroflot – 10, Transaero – 7, SAT – 1)
Boeing 767	6 (Aeroflot – 4, Transaero – 2)
Boeing 777-200	2 (Aeroflot)
Airbus A310	11 (Aeroflot)
DC-10-40F	2 (Aeroflot)
Total	39
Administrative jets	
Falcon 900	2 (Gazpromavia)
Falcon 20C-5	1 (Meridian)
Falcon 20D	3 (Avkom – 1, Jet-2000 – 2)
Bae-125-700, -800	4 (Avkom – 1, Aero-Rent – 1, Meridian – 1, Jet-2000 – 1)
Cessna 208B	1 (Avkom)
Gulfstream	1 (Surgutneftegaz)
Total	12
Helicopters	
AS-355N	1 (Kogalymavia)
Total	1

Employing simulators to train flight personnel considerably reduces service lives of aircraft, as well as money, earmarked for buying aircraft fuel. For instance, it costs \$2,000 to carry out an hour's flight on a Tu-154, and less than \$30 on a simulator.

At the present time civil aviation flight schools employ the following simulators: Tu-134A, Tu-154B(M), Tu-204-100, Il-18, Il-62M, Il-76TD, Il-86, Il-96-300, Yak-18T, Yak-40, Yak-42, An-2, An-12, An-24, An-26B, Mi-2, Mi-8T, and A310. There are no simulators for instructing pilots in the skills necessary for flying Il-114s, An-124-100s, Tu-204-120s, Tu-214s, An-38, and Mi-8AMT helicopters. Mi-26T helicopter simulators, manufactured and delivered by aircraft industry, have not been fielded yet.

It is worth mentioning that most simulators were developed and produced in the



MARKET OR BAZAAR?

The very question was answered at the annual meeting of the Aircraft Operators Association. The meeting addressed letters to Sergey Frank, Minister of Transportation, and Yuri Koptev, Rosaviakosmos Director General, persuading them to establish free market in Russia in the sphere of air transportation, which would provide equal rights and opportunities for all participants, as well as to stop vesting state preferences in a single air carrier, namely Aeroflot, and square out the tax policy.

Air carriers seemed especially concerned about tougher terms for extending aircraft service life - now it is necessary to obtain several additional permits from Rosaviakosmos.

Air carriers also arrived at a conclusion that aircraft industry was not ready to satisfy the needs of air carriers in new aircraft. Air carriers have to "queue and wait" to receive Tu-204-100 and Tu-214 aircraft, while aircraft fleet has to be upgraded already now. In addition to that the Tu-324 regional aircraft is not ready to be launched into production, while Tu-334 short-haul airliners are just being launched into series production, and can only be expected to be delivered in several years' time.

Valery AGEYEV

Photos by Sergei SERGEYEV

1970s-80s, their service life expired a long time ago. Besides, they are fitted with obsolete visual indication systems and considerably differ from aircraft cockpits, manufactured later on. Given the fact that the lion's share of the total air traffic will be carried out by the existing aircraft in the near future, it is of paramount importance to upgrade simulators.

One of the crucial tasks is to develop simulators to provide pilots with skills necessary for flying such new-generation aircraft as Il-114, Tu-214, Tu-204-120, Tu-334, Be-200, An-124-100, and Mi-8AMT.



FLIGHT DISPATCHER: A NEW WORD IN RUSSIAN CIVIL AVIATION

**Aeroflot presses ahead with its
new Flight Dispatch Service**

It turned out in 1992, when Aeroflot started operating A310 airliners whose crew consisted of two pilots, that the volume of primary flight data to be analysed and processed on board the plane at pre-flight stages and during flight increased drastically. This impaired quality of crews' pre-flight preparation, affected flight schedule, decreased economic efficiency and, to a certain extent, safety of flights.

Having analysed the situation and explored experience of other operators, Aeroflot's navigation and navigation support division worked out a plan and got it cleared aiming to set up a new division named Flight Dispatch Service.

Foreign flight dispatchers are officially licensed aviation specialists whose service is determined by state aviation rules. They share responsibility with pilots as regards flight safety.

The institute of flight dispatchers developed as demand for air transportation services grew. At the dawn of air navigation, pilots were to load mail, baggage, cargo, and facilitate passenger seating in airplanes. There were no flight plans or weather forecasts at that time; no one could help pilots out if there were changes in flight route. Air navigation, dedicated equipment and communications means ruled out any possibility of monitoring



flights just to provide timely assistance for crews in case of emergency.

As flights became more frequent, they became even more dangerous. Air crashes killed lots of people and destroyed expensive equipment. It was obvious that the state had to administer flight service.

In 1938, Congress issued a Law of civil aviation setting stringent requirements that obliged all carriers to ensure maximum safety of flights. Under the law, an institute of flight dispatchers, also called captains on the ground, was introduced. It was them, who were in charge of ensuring the maximum level of flight safety.

Nowadays, under US legislation, any carrier operating aircraft fitted with more than nine seats are to employ a corresponding number of flight control centres staffed with FAA-licensed flight dispatchers. The dispatchers exercise control over 1,000 flights daily, both in the USA and around the world.

A decade ago flight delays were mostly caused by weather conditions and aircraft malfunctions, whereas today statistics attributes them to mistakes in flight navigation support. Even a most experienced pilot can hardly select and assess information essential for generating a flight plan and executing a safe flight given one hour for pre-flight preparation. Here is when a flight dispatcher comes into play.

He can talk directly to the crew, no matter where in the world the plane is, send them reports on weather conditions over destination and alternate airports, warn them of hazards en route, suggest changes in the flight plan.

Establishment of Operational Control Centres incorporating flight dispatch service is effectual from both flight safety and economic perspective. For instance, the Delta air carrier spent five years and \$29 million on such a centre to get \$81 million during the first year of its operation.

Russia has no flight dispatchers so far. This is because our legislation, including the Aviation Code of the Russian Federation, has no definition of the occupation. There are neither training centres and instructors to teach specialists, nor job specifications.

However, this year Aeroflot managed to solve the problem sending two groups of flight navigation and navigation support specialists to the US Sheffield School of aeronautics under the Flight Dispatcher programme in January and February respectively. Following a six-week course they will take state examinations to get certified by FAA as flight dispatchers.

First Sheffield School graduates will prepare rules regulating flight dispatchers' activities, training programmes and tutorials. Then the carrier's pilots training centre will be used for train-

ing future dispatchers. Entrance requirements for the course will be most stringent, obliging applicants to have higher special aviation education (pilot, navigator, air traffic controller, flight navigation support specialist), pass psychological testing, qualify for the Upper Intermediate level of the English language, be older than 21 and pass the entrance exam showing the basic knowledge level in aviation. Naturally, those passing such stringent selection will be duly paid (in most airlines flight dispatchers get as much as pilots of Boeing 737 or A320).

Creation of the Flight Dispatch Service made the airline exercise previously outlying functions. For instance, operators can now submit flight plan directly to the corresponding air traffic control authority rather than control of the aerodrome of departure. Airlines should also be able to use different weather report sources and have remote access to computer meteorological data bases.

Aeroflot's experience in establishing the Flight Dispatch Service should not be ignored when preparing national laws regulating flight dispatchers' activities. It can also be used by other carriers willing to follow suit.

Vladimir NARTOV,
Chief Navigator,
Aeroflot – Russian Airlines



KnAAPO AIRCRAFT

TO SATISFY MOST FASTIDIOUS CUSTOMERS

The Komsomolsk-on-Amur Aircraft Production Association (KnAAPO) is the leading enterprise of Russia's aircraft-building industry specializing in manufacture of both civil and military assets. For almost half a century the company has been successfully operating on the international market of combat aircraft. Su-7B and Su-22-series supersonic fighter-bombers are now operated by armed forces of many nations all over the world. Within the period of their mass production the Komsomolsk-on-Amur plant was the largest combat aircraft exporter in the Soviet Union. From 1964 over 2,000 aircraft of the Su-series have been delivered to 19 countries.

Assets produced by KnAAPO are extensively used by Latin American nations as well. Su-22 fighter bombers built in the city of Komsomolsk-on-Amur were included in the inventory of the Peruvian Air Force in 1976 and are still very much in service.

Now KnAAPO is the producer of the world's best Su-27 fourth-generation fighters, upgraded versions of the aircraft classified as 4+ generation assets. All the Su-27 single-seaters currently in service with the Russian Navy and Air Force were produced by the Komsomolsk-on-Amur plant. New two-seat derivatives of the renowned aircraft were put into production in the late 1990s.

The Su-27SK tactical single-seat fighter was the first export version of the Su-series aircraft, production of the fighter commercialised by the company in 1991. The assets of the type were exported to the Chinese People's Democratic Republic and Vietnam. Later Chinese experts started license-production of the aircraft; in this regard a special mention should be made of the contribution made by KnAAPO representatives to streamlining manufacture processes in the town of Shenyang.

The Su-33 deck fighter enjoys a special status in the company's production plans. Assets of the type have been in production since 1989 and are now employed as part of the aircraft complement of the Admiral Kuznetsov aircraft carrier with the Navy's Northern Fleet. Su-33 fighters boast a great export potential, for the aircraft can be based both on carriers and airfields and, what is more important, have some major advantages over their ground-based counterparts.

Designed as ship-based assets, Su-33s have an enhanced service life and are immune to humid environment. Folding wings enable the aircraft's accommodation in smaller hangars, while superb aerodynamic performance in take-off and landing modes, along with extendable hooks, ensures reliable operation from very short strips fitted with

arresters, the total length of the strip mounting up to several hundred metres. The in-flight refuelling system is another important advantage of the aircraft that, among other things, can be efficiently employed as air tankers. The number of Su-33s' hardpoints has been increased to 12.

Development and production of the Su-30MK two-seat multirole fighter was a major milestone in the work on Su-27-series aircraft. The new fighter designed to operate in air-to-air and air-to-surface modes mounts an upgraded weapons control system used to employ guided and unguided munitions against ground-based targets, as well as to map terrain. The Su-30MK avionics will feature new data channels and a new generation computer with improved software interfaced with radio and electronic assets of the aircraft, as well as with data exchange duplex channels. Apart from that, the fighter will be fitted with an advanced indication system based on large multifunction LCDs. Late in 2000 the first batch of export aircraft built by the KnAAPO company was dispatched to the customer; since then every year the enterprise has been producing several dozen aircraft of the type for sale abroad.

The Su-35 super-agility multirole fighter is the most advanced asset of the Su-27 series. KnAAPO produces both single- and two-seat ver-

sions of the aircraft. The first batch of Su-35s was manufactured in Komsomolsk-on-Amur in 1992; in 1996 three fighters entered the inventory of the Russian Air Force.

Su-35 and Su-35UB aircraft now on offer to foreign customers feature canards, upgraded fly-by-wire system, and an in-flight refuelling system. Enhanced fuel endurance is, too, an important advantage of the fighters. The aircraft boast cutting-edge avionics and carry a greater variety of air-to-air and air-to-surface guided munitions ensuring multirole capacity of the fighters.

The Su-35's super-agility single-seat derivative with variable thrust vector has already got acclaim from experts in many countries of the world where the aircraft was for the first time displayed in the course of international air shows. Latin American nations are no exception. In spring 1998 the fighter, along with the Su-30K two-seater, participated in the FIDAE '98 international air salon held in Santiago, the capital city of Chile. The aircraft were later exhibited at Anapolis Base of the Brazilian Air Force on the occasion of the forthcoming tender for assets intended for renewal of the country's fighter fleet.



Su-80GP

its superb manoeuvrability for themselves flying the aircraft at Anapolis Air Base.

Apart from production of new Su-27-series derivatives, the KnAAPO company has been recently assigned the status of the major enterprise specialising in repairs and upgrade of in-service aircraft of the type. In accordance with the program approved by the Russian Air Force, upgrade of the Air Force fighters to the 4+ generation standard was started at the plant in 2002. The initial phase of the project was followed by the tests of the first upgraded Su-27SM fighter in service with an Air Force unit. This year the first Su-27SMs will undergo

compliance with the Russian AP-23 and international FAR-23 airworthiness standards can be efficiently operated on short air routes in areas with plenty of reservoirs making employment of other means of transportation extremely difficult. The aircraft is capable of airlifting four or five passengers and light cargoes, their weight mounting up to 400kg. Apart from that, the Be-103 can be used on maritime patrolling missions, as a sanitary, training and an agricultural asset.

The first Be-103 amphibian was built in Komsomolsk-on-Amur in 1996. As many as five aircraft have been manufactured so far. Mass production of the first batch of three Be-103s to be exported to the United States began in 2002. The amphibian was effectively certified in accordance with the Russian AP-23 standard, the type certificate issued on 26 December 2001. In 2003 the Be-103 is to undergo certification procedures for the US FAR-23 airworthiness standard that will enable the aircraft's export to customers all over the world.

Production of the Su-80 multipurpose turboprop airlifter is another project of building civil aviation assets. The transportation version of the aircraft designated as the Su-80GP is used to airlift 30 passengers or 3,300kg of cargo. Apart from that, a great variety of other versions, i.e. patrol, transportation and landing aircraft, navigation trainers and sanitary aircraft, have been derived from the baseline Su-80.

Flight tests of the first Su-80GP prototype of the KnAAPO produce have been in progress since 2001. Assembling of the second prototype is now being finished at the plant, with production of another two aircraft under way. All the airlifters will undergo certification tests to be over by the end of 2004.

International acclaim, as well as extensive experience gained by the experts of the KnAAPO company in the course of building both sophisticated combat and civil aircraft, and efficient production facilities boasting cutting-edge equipment will ensure KnAAPO's leading positions in the industry of producing advanced military and civil aircraft. The capabilities of the company will surely make it the major production centre of the Sukhoi Holding Company now being set up.



Be-103

Test pilots of the Sukhoi Design Bureau, Heroes of Russia Yevgeny Frolov and Igor Votintsev flew the aircraft to make an unprecedented flight from Russia to South America along the route Moscow - Anapa (Russia) - Malta - Casablanca (Morocco) - Sao Island (Cape Verde) - Recife (Brazil) - San Paulo (Brazil) - Mendoza (Argentina) - Santiago (Chile) - San Paulo - Brasilia (Brazil) - Anapolis (Brazil) - Recife - Sao Island - Casablanca - Malta - Anapa - Moscow. The pilots crossed the Atlantic Ocean without intermediate landings and additional fuelling, a fact that in itself proves outstanding capabilities of the Russian fighters. The total length of the route exceeded 16,000km. The upgraded Su-30K two-seater was highly commended by Brazilian pilots and Air Force commanding officers who assessed

upgrade trials and will be later dispatched to their units. Several more aircraft of the type will follow the trend. Upgraded Su-27 fighters will be fitted with advanced avionics and new high-precision armament that will greatly enhance their combat capabilities in air-to-air and air-to-surface modes.

However, mass production, repairs and upgrade of military aircraft is not the only aspect of KnAAPO's activities. For several years now the enterprise has been pursuing programs, their principal objective being development and production of civil and dual-purpose assets. Experts of the plant are currently engaged in two projects of the kind, specifically, manufacture of the Be-103 amphibian and Su-80 multipurpose transportation aircraft.

The Be-103 amphibian designed in strict

Andrei FOMIN



AN-140

SIBERIAN TOUR

BRAND-NEW AIRCRAFT BY KHARKOV MANUFACTURERS ATTRACTS NEW CUSTOMERS

Russia's unique geographic and climatic conditions, its sparse overland transportation network typical of North-European parts, Urals, Siberia and the Far East coupled with the grandiose dimensions of the country dictate the necessity for a wide use of transportation by air.

The Siberian region is rich in all kinds of natural resources, oil and gas included. There are as many as a few dozen national airports and a great many regional air traffic centres in Siberia with hundreds of airplanes ploughing through the Siberian sky. Among the 35 major companies which provide 91 per cent of air transport service are KrasAir, Sibir, DalAvia, TumenAviaTrans, Uralskije AviaLinii and many others.

The role which Siberia had played in providing air communication with foreign countries increased in November 1998, when six new corridors in its air space were opened for international flights, namely Tiksi – Zhigansk – Vilujsk – Olekminsk, Tiksi – Yakutsk –

Magdagatchi, Tchokurdakh – Tchagda – Magdagatchi, Tchokurdakh – Yakutsk – Aldan – Mogotcha, Mogotcha and Nizhnetombovskoje. According to the experts with the State Civil Aviation Service of the Russian Federation, the opening of the new corridors was an event of national importance because this country's air space, formerly a restricted area, became more available to foreign companies which are to pay from \$39 up to \$72 (depending on maximum take-off weight of the aircraft) into the Russian budget for every 100km travelled in the Russian sky. Approximately \$100-120 million come into the Russian budget as annual air navigation service fees.

As estimated by the International Air Transport Association, the operation of polar routes alone can swell Russia's annual budget by \$75 million charged as air navigation fees.

It is in manufacturing plants of Siberia and the Far East that over 70 per cent of the aircraft to be exported are produced. The Siberian companies KrasAir and DalAvia were the first

to master the operation of new generation passenger planes – Tu-204 and Tu-214 respectively.

Yet the two aforementioned aircraft are far from holding the leading positions on the Siberian market of air transportation. The bulk of the air fleet has become technically obsolete. That's why it is only natural that Director General of the Kharkov State Aircraft Manufacturing Company (KSAMC) Pavel Naumenko said: "The Siberian land is rich all right. What not do we find here: gold, diamonds, oil and wood. The only thing we do not find here, though, is a sufficient number of modernised, quality aircraft. But our company can offer you such an airliner. I am talking about the An-140, one of the most suitable assets to operate in the harshest conditions of the North, Siberia and Polar areas."

It is true that this aircraft of the new generation meets present-day international requirements, its principal advantages being high speed, safe and silent operation, cost-effective-

ness, modern design of the passenger cabin and seats, high manoeuvrability and perfect navigation system.

In late March this year a large group of aircraft builders and engine manufacturers from Ukraine, representing ANTK Antonov, KSAMC, Motor-Sich, the Zaporozhye-based Progress Design Bureau, as well as Ilyushin Finance made an air-tour around Siberia calling at Kharkov, Yekaterinburg, Krasnoyarsk, Yakutsk and Khanty-Mansiysk to demonstrate the An-140's excellent flight characteristics.

Talking of the demonstration flight, KSAMC Director General P. Naumenko said that this was a working tour, agreed upon at an earlier stage within the framework of meetings attended by the heads of a number of Siberian airlines. Welcoming the Kharkovites in Yekaterinburg were Uralskije AviaLinii, one of the biggest companies in the whole of Siberia. In 2002 the company carried as many as 415,000 passengers on its domestic flights, the number exceeding that of the 23



KSAMC Director General Pavel Naumenko met a new business partner on board a plane



Ukrainian airlines taken together. In Krasnoyarsk the experts held talks with the SibAviaTrans company, which plans to purchase three An-140s.

The government of the Republic of Sakha (Yakutia) held a large meeting, deliveries of the An-140 to the republic being the chief issue on the agenda. Today Yakutia is one of the richest regions in Russia. The republic's annual budget totals \$1,000,140,000 with the population of 980,000 people. The most effective means of transportation is air which accounts for 57 per cent of the passenger turnover.

The newly-born Yakutia carrier plans to purchase three An-140s, the other two aircraft to be delivered to the Alros company. The aircraft in question are planned to carry passengers from Yakutsk to Khabarovsk, Blagoveshensk and Krasnoyarsk.

ANTK Antonov together with KSAMC are to provide technical support, training of pilots and technical staff of the company. The government of the Republic of Sakha has decided to budget-

fund acquisition of An-140 aircraft manufactured in Kharkov.

Presentation of the An-140 staged at the Khanty-Mansiysk airport was a hit, too. Of the 89 component parts of the Russian Federation the Khanty-Mansiysk Autonomous District rates first in oil production, second in power production and third in gas production. Each resident in this district travels by air at least once a year, which is higher frequency than in any European country while only the US residents take off and land more frequently.

It was also stressed by P.Naumenko that ANTK Antonov and KSAMC in addition to the delivery of the An-140 also provide the purchaser with a maintenance programme which includes a finished "turnkey" maintenance base, training of pilots and technical staff, supplies of spare parts, tools, ground-based testing equipment and technical documentation.

The abovementioned technical maintenance base will enable specialists to carry out various tests, make adjustments and assemblies of nav-

igation, radar, electronic and instrument devices, hydraulic, hydrogen and fuel systems and autopilot. Training of pilots and technical staff employs traditional approaches and methods as well as computer programmes on CD-ROM.

Speaking of the results of the Siberian tour, Mr. Naumenko stressed the fact that many Russian companies could benefit from purchasing as quality aircraft as the An-140. Given the demand for the model the Ukrainian industry will be able to satisfy it. The Kharkov company has already won the order to manufacture ten An-140s in 2003, with 12-14 aircraft of the type ordered for production in 2004. Besides, another An-140 is scheduled for building in the Samara-based Aviakor plant later this year.

The An-140 aircraft is popular abroad, too. Many companies from Kazakhstan, China, Iran, the South African Republic and other countries have expressed their intention to have such aircraft in their air fleet.

WATER AERODROME IS SOMETHING REAL

Flying boats and floatplanes accounted for a fair share of the global aircraft fleet only 60 or 70 years ago. With ground aerodromes scarce as they were, hydroplanes enjoyed universal popularity due to the ubiquity of rivers, lakes and seas across the planet. This advantage appeared obvious while takeoff and landing speeds kept low and good weather remained a mandatory operational condition for land- and water-based airplanes alike. As constantly growing airspeeds led to an increase in takeoff/landing speeds (water proved to be rather hard when used for high-speed landing), and people dreamed of all-weather aircraft, carriers and air forces the world throughout began dismissing flying boats from their fleets. A handful of hydroplanes still in service are used exclusively in special missions such as fire fighting and search-and-rescue operations.

But even these limited functions largely depend on weather. The A-40 amphibious airplane, viewed by many as the most perfect machine of its type, can neither land nor take off at wave height exceeding two meters; the

Be-200 can only operate at wave height 1.2m or lower, and the Be-103 requires wave height of not more than 0.5m. An amphibian aircraft can certainly land at a ground aerodrome any time, but this will annihilate its only superiority over ground-based airplanes.

Despite the abundance of water on the Earth, there are few natural water aerodromes suitable for all-weather operation of amphibious aircraft. Another problem is that appropriate harbours are typically found in just the wrong place, and building artificial harbours is too expensive to pay off in every given case.

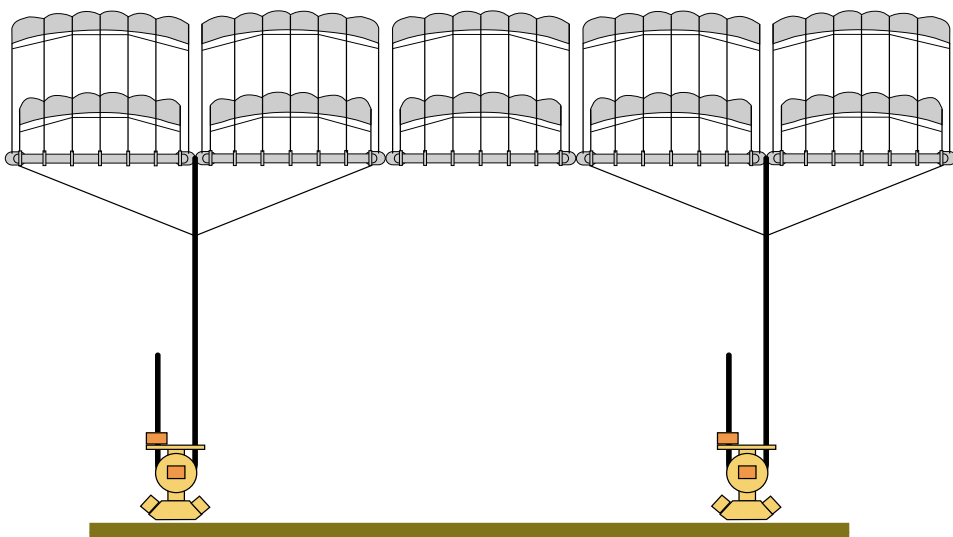


Deployment of a water aerodrome network is, therefore, only possible if someone proposes a method for building harbours protected against high wave that would be attractive enough for investors.

Work on an applied problem gave a team of Russian scientists a thorough comprehension of how waves form and break. The scientists tested the research results in laboratory environment and predicted the possibility of devising a cheap and efficient wave calming system. A design study run by company MiG-Service demonstrated that such a system can exist in both stationary and mobile versions and consist of modules; configuration of modules will depend on the type of waves to be calmed. Several clusters of underwater modules will form the system as a whole.

Buoyant modules will be anchored to the bottom of the harbour, with the deployment depth depending on the required wave height after breaking. The system can be deployed in however deep harbours, its size being a major determinant factor for efficient wave calming. The automated version takes several hours to deploy, which makes it indispensable in emergencies.

This invention can be used in building a relatively cheap network of water aerodromes for virtually all-weather hydroplane operations, and might in the long run lead to renaissance of international hydroaviation.





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Nowadays Russia, Ukraine and other CIS nations are operating some 120 Yak-42 short-haul passenger aircraft and over 100 An-72 and An-74 military transports and regional freighters. What brings so different aircraft together is the D-36 engine, which is the central element of their power plants. The modern economical low-noise turbofan was developed by the Zaporozhye-based Ivchenko Progress Design Bureau and is produced by Motor Sich JSC.

It was in the late 1960s, that Progress initiated development of an engine that would differ from the rest Soviet-made turbojets intended for passenger and transport aircraft. By then the design bureau had already accumulated experience in developing reliable and economical gas turbine engines. It was Progress that in the late 50s developed the USSR's first extended-life AI-20 turboprop installed on Il-18 passenger aircraft and An-12 transport jets, as well as a large variety of their modifications. Progress was the



D-36 SERIES 4A: OLD ENGINE, NEW CAPACITY

first in the Soviet Union to design in the mid-60s a turbofan engine AI-25 intended for local airlines; today the engine powers Yak-40 aircraft operated across the globe.

Progress pioneered many engine developments. It was the first in the USSR to develop high by-pass ratio D-18 turbofans with a thrust of over 20t that have ever since been powering the world's largest An-124 Ruslan and An-225 Mriya transports. The world's most powerful D-136 turboshaft installed on the heaviest production helicopter Mi-26, as well as D-27 propfan for the An-70 transport were, too, Progress' novelties in the domain of engine manufacturing. These are just a few of the design bureau's

achievements. Progress-designed engines are nowadays installed on 42 types of both fixed- and rotary-wing aircraft that are being operated by 63 nations.

The IAC aircraft engine development certificate, the Bureau Veritas quality certificate and the Aviation Register aircraft engine repair certificate of state Department of an air transportation of Ukraine mean that the design bureau's expertise is widely recognised.

Back in the 70s, the D-36 engine designers were to make an economical, yet reliable and easily serviceable engine. They opted for a novel, three-shaft design with the fan, the low and high pressure compressors linked gas-dynamically.

What's more, the turbofan featured high by-pass ratio (over 5). Higher gasdynamic parameters, namely greater gas temperature before the turbine called for use of new materials and design solutions. To improve the engine's maintainability modular design was chosen.

In 1971 the first D-36 prototype commenced bench

testing to begin flight trials on a flying laboratory three years later. Design characteristics were achieved with the bench thrust of 6,500kgf and specific cruise fuel consumption of 0.63kg/(kgf•h), that at takeoff being 0.35kg/(kgf•h). The turbofan's by-pass ratio amounted for the first time in the USSR 5.6.

As a result, the power plant had already progressed through most tests by the time the first Yak-42 was manufactured. The first Yak-42 prototype, powered by three D-36 engines, made its maiden flight in 1975, and a short time later the new airliner was launched into mass production. The D-36 was launched into series production in 1977. Yak-42s started regular passenger operations in 1980 and have been successfully fulfilling their missions ever since.

The year of 1977 also saw the maiden flight of the new An-72 transport prototype, which mounted two D-36 power plants on its wing. An-72 military transports and An-74 regional air freighters and cargo-passenger aircraft were launched into mass production in 1985. At the present time about 190 Yak-42s and Yak-42Ds, and in excess of 170 An-72s and An-74s have been produced. All of them are fitted with D-36 engines (series 1 and 1E on Yak-42s, and series 2A and 3A on An-72s and An-74s). At the moment Yak-42 airliners are in the inventory of such countries as Russia, Ukraine, Kazakhstan, Turkmenistan, Lithuania, China, Cuba, and Iran. An-72 and An-74 transports are in service with the Russian Air Force and air carriers, Ukraine,



other former CIS member-states, Peru, and Iran. A number of other foreign states have expressed their interest in the aircraft.

At present D-36 power plants are in service with 30 companies and feature a total operating time of about 5.5 million hours. According to statistics, the number of engine shutdowns in the air per 1,000 operating hours totals only 0.015, while the rate of replacing the engine before its service life expires is less than 0.05. The D-36 is one of the few power plants in service with Russian aviation, which meets tough noise-abatement requirements.

The D-36 series 3A engine features an additional emergency operation mode, which boasts the takeoff thrust at high outside temperatures. This fact enables aircraft, powered by engines like that, to successfully take off from alpine airfields, situated up to 4,000m above sea level.

The engine's successful design and outstanding specifications allowed its gas generator to become the basis for developing a host of modifications: the D-136 helicopter turboshaft, the D-236T propfan demonstrator, the D-336 industrial engine, as well as a score of other industrial power plants. In addition to that, in 1992 the D-36 also became the backbone for designing a new family of highly efficient D-436T1 (TP, T2, T3, etc.) three-shaft turbofans with a thrust of 7,500-9,000kgf to be fitted on future Tu-334 and B-200 aircraft, etc. At the present time the engines in question are undergoing certification tests on Tu-334 (D-436T1) and Be-200 (D-436TP).

Several design innovations, introduced during the D-436T1 development, were decided to be also employed for upgrading the mass-production D-36. For instance, the upgraded D-36 series 4A turbofan, fitted on the An-74TK-300 utility cargo-passenger aircraft, was developed in 2000. Unlike previous modifications of An-72 and An-74 aircraft, An-74TK-300 mounts the engines in underwing engine nacelles, rather than on the wing proper, which resulted in introducing new thrust reversals and their pylons.

The An-74TK-300, powered by two D-36 series 4A engines, made its maiden flight on 20 April 2001, while as early as in September 2002 the aircraft was certified by the Interstate Aviation Committee Aviation Register. The certificate enables the aircraft to be exported both to CIS member-states, and foreign countries.

What are the main features of the D-36 series 4A turbofan? The three-rotor axial-flow

compressor comprises a supersonic fan, a six-stage transonic low-pressure (LP) compressor, and a seven-stage subsonic high-pressure (HP) compressor. Low- and high-pressure compressor inlet guide blades allow the engine to be fine-tuned on a test bed. Bleed valves behind the third stage of the LP compressor and the fourth stage of the HP compressor provide compressors with gas-dynamic stability, when the rotors are started or operate at low rpm. Dampers are employed to improve operation of bearings and reduce vibrations.

The annular combustion chamber incorporates the outer hull, the diffuser with directing vanes of the HP compressor, the manifold flame tube with 18 nozzles, two flame-type igniters with the capacitive ignition system, and the nozzle assembly of the HP turbine. The flame tube

The three-shaft axial turbine consists of single-stage HP and LP turbines, and the three-stage fan turbine. The cooled rotor blades of the HP turbine are made up of a high-temperature alloy in compliance with the high-speed oriented crystallisation technique, and boast a high-temperature gas-circulation coat, which provides them with required performance during the long service life. The HP turbine stator passive temperature control system allowed the peripheral clearance to be reduced and stabilised at varying modes of operation. The LP turbine rotor blades are also made of a high-temperature alloy in compliance with the high-speed oriented crystallisation technique, and boast a high-temperature aluminium silicated coat. The fan turbine design enables the module to stay operational at specified parameters for the specified service life.

The D-36 series 4A engine is fitted with two-position annular cascade reverser (forward thrust, and reverse), capable of providing a reverse thrust by turning the air flow in the bypass duct by 130 degrees and reliable deceleration during the landing roll.

The engine's modular design allows modules to be replaced during operation. The automatic control and adjustment system facilitates automatic control and maintenance of engine parameters during the start up and certain modes of operation, as well as protects the engine at critical values.

Much attention has been paid to facilitating control over the engine's performance. Control and processing of 25 main parameters and 20 binary signals in compliance with corresponding algorithms of the engine monitoring and alert system provide data on the state of engines and their subsystems, as well as their parameters, and allow their technical state to be predicted. The engine is fitted with special access holes, which provide visual contact by means of optical devices (borescopes), designed to monitor compressor and turbine rotor blades, fuel injectors, the combustion chamber flame tube, and the HP turbine nozzle vanes. There are also non-destructive engine components testing means.

Bench tests and flight tests of the D-36 series 4A power plant on the An-74TK-300 aircraft prove that the Progress Design Bureau has developed a contemporary, highly reliable, powerful, and efficient engine, capable of both providing successful operation of the aircraft in question, and becoming a basis for future modernisation of the famous turbofan.



D-36 Series 4A basic specifications

Emergency power conditions (H=0, M=0, ISA+15 °C)

Thrust, kgf	6,500
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Takeoff power (H=0, M=0, ISA)

Thrust, kgf	6,500
-------------	-------

Specific fuel consumption, kg/(kgf•h)	0.35
---------------------------------------	------

Maximum cruise power (H=8 km, M=.75, ISA)

Thrust, kgf	1,600
-------------	-------

Specific fuel consumption, kg/(kgf•h)	0.63
---------------------------------------	------

Maximum cruise power (H=9.15 km, M=.6, ISA)

Thrust, kgf	1,500
-------------	-------

Specific fuel consumption, kg/(kgf•h)	0.56
---------------------------------------	------

Engine weight, empty, kg	1,130
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ISA – International Standard Atmosphere

boasts smaller dimensions in order to reduce emission. The HP turbine nozzle assembly features a more sophisticated design, achieved due to employing the 3D design technique. The combustion chamber is reliably ignited, and thus the engine is reliably started without preheating at a temperature of -40 to +50 degrees Centigrade on the ground or at an altitude of up to eight kilometres.

BANGALORE'S BLUE SKIES



On 5-9 February 2003 the Indian Air Force Yelahanka airbase, situated just outside the city of Bangalore, the capital of the Karnataka state, hosted the Aero India international air show for the fourth time. This year the international aerospace industry was represented by 176 companies from 22 states. This is the all-time high figure for the air show in question.

Open parking areas outside exhibition halls housed 68 aircraft, including 52 Indian ones. This year Russia demonstrated the MiG-29M2 multirole fighter and the MiG-AT trainer, the UK displayed the Hawk 100 training aircraft, Germany exhibited the medevac modification of the C-160 Transall air transport, while the Czech Republic came up with the L-159B combat trainer and the An-26 combat support transport. The honorary guests of the air show comprised the Dassault Aviation Falcon 900 and Falcon 2000 CJ business jets, as well as the Brazilian Embraer 135 Legacy VIP aircraft.

As is customary, the air show was officially opened by the Indian Minister of Defence. In his opening remarks George Fernandes outlined a new workstream for national hi-tech industries, saying: "India has yet to exploit her potential in the area of high technologies to the full extent. We are looking into a feasibility of establishing a defence industry, capable of manufacturing world class products at competitive costs jointly with the private sector of national economy!"

A NEW WORKSTREAM IN DEFENCE INDUSTRIAL COOPERATION

It is worth mentioning that up till now the Indian government has been enjoying a 100 per cent control over the national defence industry. According to the Defence Minister, from now on private companies and even foreign investors will be involved in the process. The latter have been outcast from the sphere in question only recently, as the whole of defence industrial cooperation developed strictly along the lines of intergovernmental agreements. Such a turn of events can only mean that the nuclear India no longer wants to stick to the 'small brother' role in her relations with new and old counterparts,

but on the contrary is eager to get out of the bit player routine, if not to star, in the international arms market.

Defence industry experts pinpointed a certain critical trend, inherent in rich and choosy customers, in negotiations with the Indian side a long time ago. Now this trend has been confirmed by a senior official, and all relations with the mysterious and faraway India will have to be based on the new groundwork.

This is not just a mere freak of Russia's long-term political and defence industry partner. India wants to procure western high technologies, rather than specific aircraft, tanks, or missiles, thus assuring her future. It is only natural

MiG-21 Bison upgraded fighter



that India is not eager to depend on a single arms contractor, but wants to distance herself somewhat from her partners, at the same time maintaining traditional relations and emphasising her potential and her new policy of 'open architecture'.

Given the facts mentioned above, it is worthwhile to analyse Aero India 2003. The air parade, opening the air show, was led by Mi-8 helicopters, carrying the Indian national flag, as well as colours of the Indian Air Force, Navy, and Army. They were followed by two An-32s and a Do 228, after which quite an unusual formation made its appearance over the airstrip. It was led by a light ALH helicopter, followed by a V-formation of a Kiran II trainer, a pair of Mirage 2000s, and a pair of cutting-edge Su-30MKIs. Given the difference in speeds, an outside temperature of 30 degrees Centigrade, and alpine terrain (the Yelahanka airbase is situated 700m above sea level), one can only imagine the burden, the pilots, flying the supersonic fighters, had to shoulder!

PRIDE OF INDIAN AIRCRAFT INDUSTRY

Aero India 2003 saw for the first time public demonstration of aerobatics performed by the LCA light fighter. The maiden flight of the second TD-2 technological demonstrator at the aforementioned air show was carried out by test pilot Suneet Krishna, who demonstrated a steep climb, a sharp turn, and a number of level flight stunts. During the previous Indian air show the LCA aircraft (back then it was known as the TD-1 prototype) carried out just one pass over the airfield, but now this aircraft, which had earlier been thoroughly concealed from public, was demonstrated both in the air and on the ground. It was surrounded by a formidable arsenal, incorporating KAB-500Kr guided bombs, ODAB-500 fuel-air explosive bombs, missiles, and rockets. The weapons emphasise that the aircraft is capable of attacking both air- and ground-based targets.

Besides the two LCA prototypes (the first one was exhibited at a ground stand, while the second was demonstrated in the air), the HAL 748 flying laboratory, used to test a radar for the new Indian fighter, was also displayed at the air show.

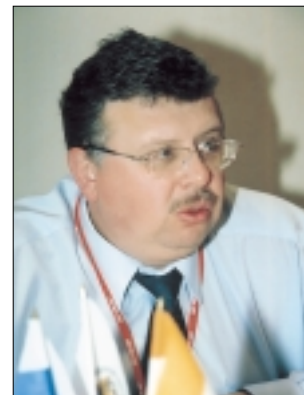
The LCA aircraft has been developed for over a decade now, and throughout the years disputes have been raging whether India needs a fighter like that. From a purely pragmatic viewpoint, the answer would be negative. Why waste so much money to develop an aircraft, which will anyway be inferior to modern combat aircraft and whose in-service date will be 2010 at the very least? However, the Indian aircraft industry considers the LCA project a training problem, the solution to which will answer the ques-



Director General of the Russian Aviation and Space Agency Yuri Koptev: "With abundant supply on the international arms market, weapons producers are forced out from their traditional domains. In this regard we should adopt a more comprehensive approach to cooperating with nations setting up defence industries of their own. As far as Russian relations with India are concerned, we are avoiding conventional "customer-supplier" schemes trying to apply offset projects that are more preferable for our partner."



President of the Irkut Corporation Alexei Fyodorov: "We intend to exploit our success on the Indian market and are ready to offer to our partners new joint projects in developing transportation and commercial aircraft. The agreement signed in the course of the exhibition is strategically important, for the HAL company gains a customer in Russia, while Irkut is granted a unique opportunity to further promote mutual cooperation between the two countries."



Director General of the Rosoboronexport Federal State Unitary Enterprise Andrei Belyaninov: "We have something to offer to India as far as anti-aircraft assets are concerned, and we are going to adopt a most aggressive approach in this regard."

tion, whether India is capable of independently developing and manufacturing world class supersonic fighters, or whether her fate is to procure foreign aircraft. The policy, articulated by the Indian Defence Minister, makes it clear that no resources have been or will be spared for the LCA programme, moreover so that in excess of a hundred various enterprises, based in 28 cities across the country, are involved in the project.

Unlike the TD-1, the second TD-2 prototype features a new integrated communications system, and a new head-up display. The aforemen-

tioned systems have been developed by Indian experts. The TD-2 made its 30-minute maiden flight on 6 June 2002 with test pilot of the National Test Flight Centre (NTFC) Tapan Banerji at the controls.

In May 2003 the first two technological demonstrators are to be followed by the first of

five prototype vehicles (PV-1). The second aircraft (PV-2) is to make its maiden flight in September, while the third one (PV-3) in December. The first flight of the fourth prototype vehicle is slated for mid-December 2004, while that of the fifth one is planned to be carried out in mid-2005. The programme is expected to enter the mass-production stage by December 2007, while in 2010 the first production aircraft will be fielded with a manoeuvre unit. The PV-1 is to boast only 43 per cent of aluminium alloys, while the rest will be made of composite materi-

Su-30MKI fighter of the IAF's 20th Sqn with full combat load in air-to-air version



als. In addition to that, for the sake of comparison, the PV-1 will be powered by the US F404-F213 turbofan, instead of the Indian Kaveri engine. Mr. Verma, Director of the LCA programme, believes that the obvious success in developing a fourth-generation fighter will convince the international community of the absurdity of sanctions, imposed on India, which is not going to depend on the US political environment.

TRAINING AIRCRAFT COMPETING FOR THE INDIAN MARKET

The same holds true with respect to training aircraft. The expected hit, related to the contract for the British Hawk trainer, never happened - George Fernandes declined to comment on the negotiations, hinting that all proposals had been submitted to the Cabinet, which would be responsible for the final decision. The protracted negotiations on selecting a new trainer for the Indian Air Force have started to cause



LCA supersonic fighter, the pride of the Indian aircraft-building industry. The second flight prototype of the aircraft in air over the Yelahanka airbase



George Fernandes at the Air Fleet stand

rumours, but the Indian Defence Minister did not unveil whether the Indian government would choose the British Hawk 100 or the Indian Advanced Jet Trainer AJT-36. According to experts, the single-engine Hawk does not meet requirements of the Indian brass in full. At the same time the AJT-36 is expected to come into service no sooner than 2006. That is why, given the situation at hand, the Czech L-159 and the Russian MiG-AT aircraft carried out demonstration flights at Aero India 2003.

The long-drawn selection of a foreign contender is first and foremost beneficial for Indian designers, working on the AJT-36 aircraft (riding past the hounds, it is worth mentioning that the first AJT-36 prototype made its maiden flight shortly after the Aero India 2003 air show was over). In the meantime the Indian Air Force pilots have to train on obsolete aircraft, to say the least. The Kiran trainer, based on the British Jet Provost, was developed by experts of the Hindustan Aeronautics Ltd. (HAL) several decades ago.

carry out aerobatics in a tight formation. India takes pride in the fact that her aerobatics team is one of the world's three teams, capable of demonstrating a nine-aircraft aerobatics programme.

RUSSIAN NOVELTIES WITH INDIAN FLAGS

The Indian Air Force Su-30MKI was the absolute star of the air show. The aircraft was flown by wing commander N.S.Jamwal, commander of the 20th squadron, deployed at the Puna airbase. Right after the takeoff he spun the aircraft in a sharp bank and a steep climb and carried out a small-radius basic loop (employing TVC nozzles). All rumours that Su-30MKI was difficult to fly were humorously deflated by squadron

leader Shrivastav, who told the reporters that it was much easier and much more pleasant to fly the Su-30MKI than drive a car in Delhi or Mumbai (former Bombay).

On carrying out a number of level turns and passing over the runway at an extremely low altitude, wing commander Jamwal accelerated the aircraft and carried out a spectacular ascending roll. At the upper point of the trajectory at an altitude of about 1,500m he shut down the afterburner, and the aircraft ... vanished into thin air, both visually and acoustically, before the eyes of amazed spectators! Jamwal's aerobatics sent the public into wild delight, though no onlookers were admitted to the air show during the first few days. It was worth seeing the airbase on open days, when hundreds of thousands of ordinary citizens, who did not know the



Chief of staff, Royal Malaysian Air Force, General Dato' Haji Suleiman bin Mahmud receives a Su-27 book

first thing either about the defence industrial cooperation, or the TVC-aided flight dynamics, swarmed the Yelahanka airbase. The Su-30MKI became the token of the Indian Air Force power, while it is next to impossible to deny the patriotism of Indian citizens. Russians were also pleased by the effect, produced by the national aircraft.

Other Russian-made sensations, demonstrated at the air show by the Indian side, comprised the first few MiG-21bis fighters, upgraded in India, and the Mi-35 combat helicopter, upgraded by Israeli experts. While the Indian MiG-21 modernisation programme, which is a clearly international undertaking, is carried out with the consent and active participation of the designer, the Mi-35 modernisation has not seen any participation of Russian companies. It is only strange that this fact should not arouse any of the usual statements from the Russian delegation, first and foremost, the Mil Moscow Helicopter Plant and Rostvertol, who have their own pro-

aircraft to maintain their combat potential and efficiently counter new-generation aircraft for at least another decade.

Development and tests of two prototypes, the modernisation programme demonstrators,

items mounting up to some 300 mock-up assets and weapon systems. Only two Russian aircraft participated in the event, both represented by RAC MiG. Daily demonstration flights by the MiG-29M2 multirole fighter and MiG-AT



Su-30MKI super-agile multirole fighter, the most sophisticated asset in service with the Indian Air Force.



Chief of Staff of the 20th Air Squadron, Indian Air Force, wing commander N.S.Jamwal: "The Su-30MKI is the most efficient aircraft of the Indian Air Force, and, most probably, the best fighter in the world!"

posals on upgrading their aircraft. They must have decided against dropping a fly in the ointment of the mushrooming Russo-Indian cooperation in defence industry. However, in any case, the fact of unauthorised modifications, introduced to Russian aircraft, must be condemned by all means.

Insofar the modernisation of 125 Indian MiG-21bis aircraft is concerned, it is carried out within the framework of the contract, signed by the Indian Air Force, the Russian RAC MiG corporation, and the Nizhny Novgorod-based Sokol Aircraft Plant in March 1996. The aircraft, being upgraded, are fitted with the contemporary Russian Kopyo radar, new Russian guided weapons (including RVV-AE and R-73E air-to-air missiles, KAB-500Kr guided bombs, etc.), a French navigation system, an Israeli ECM system, and a number of Indian systems. The improvements introduced will enable Indian MiG-21bis

Indian Air Force. With this end in view, Sokol and other Russian subcontractors started delivering modernisation equipment suites to India. The first fighter, upgraded in India, which was designated MiG-21 Bison, made its maiden flight on 31 August 2001. Several dozen Indian MiG-21bis aircraft had undergone modernisation by the time the air show was under way. Two of them were for the first time demonstrated at Aero India 2003 (one on the ground, and the other one in the air).

RUSSIANS IN BANGALORE

Russia's defence industry was represented at the exhibition by 38 major companies, the total number of displayed

basic and advanced training aircraft once more proved Russia's prestige as a leading aviation nation. Since all the issues concerning the Admiral Gorshkov aircraft carrier had been settled, its MiG-29K aircraft complement determined by the time of the exhibition, the MiG company opted for displaying other products rather than ship-borne assets. MiG Deputy Designer General and Director of the Mikoyan Engineering Centre Vladimir Barkovksy said that the MiG-29M2 fighter demonstrated in Bangalore could be used to effectively replace MiG-21 and Jaguar aircraft currently in service with the Indian Air Force. The Russian assets can also be considered a viable alternative to LCAs. Another major advantage of fielding the aircraft is that MiG-29M2 fighters can comple-

An Indian Mi-35 combat helicopter upgraded by Israeli specialists



ment the fleet of Indian MiG-29s which, on Russian proposal, can be upgraded up to the MiG-29SMT standard.

The aircraft carrier transfer being the highlight of the exhibition, George Fernandes told the press that the contract for handing over the ship to India would be signed in the near future. The information was later confirmed by Rosoboronexport Director General Andrei Belyaninov.

Russian participants in the event paid special attention to promoting defence industrial cooperation between Russia and India, as well as other nations in the region. Great importance of the Indian market for Russia was proved by the fact that the official Russian delegation to the exhibition was headed by Rosaviakosmos Director



Deputy Designer General of RAC MiG, Director of the Mikoyan Engineering Centre Vladimir Barkovksy: "Our company was the only enterprise representing actual aircraft at the Bangalore exhibition, and we hope the Indian side that has had an opportunity to see capabilities of MiG-AT and MiG-29MRCA aircraft for themselves will choose the assets for service with the national Air Force."



MiG-AT advanced trainer

General Yuri Koptev, who, among other things, expressed his deep satisfaction with the current status of relations between the two countries and the outlook for their further development. Koptev proposed to launch a joint Russo-Indian project of building a regional aircraft and a medium airlifter.

The unified stand of AVPK Sukhoi, KnaAPO and UMPO companies was the heart of the Russian exposition. The assets on display included a whole range of Sukhoi-series aircraft and an AL-31FP variable thrust engine. Director General of the Sukhoi enterprise Mikhail Pogosyan said he was quite satisfied with the company's cooperation with HAL and the Indian Air Force as far as both the Su-30MKI license production and relative training programme for Indian pilots were concerned.

An advanced simulator developed by the Aerospace Equipment enterprise made a superb complement to the Sukhoi aircraft; the asset can be efficiently used for training pilots

the utmost objective.

George Fernandes, among other things, paid special attention to the Yak-130 trainer's cockpit accommodated next to the simulator. The minister said that the adjustable fly-by-wire system of the Yak-130 aircraft provided a wide range of capabilities for training advanced pilots of various profiles. President of Yakovlev Design Bureau Oleg Demchenko said that the company had concluded a contract with the Russian Defence

in realistic combat environment.

Director General of the Russian Simulator-building Centre Viktor Aksenov said that the simulator displayed at the exhibition was capable of staging 90-95 per cent of combat patterns including airborne and ground-based targets engagement. Employment of simulating assets is some 30-60 times cheaper than use of actual aircraft depending on the type of the assets, which only adds to the importance of simulators. Experts of the centre are now engaged in development of Russia's national simulator-building concept, adjusting it in accordance with the standards of the concerned agencies.

Among those examining the simulator were India's Defence Minister George Fernandes, officers of the Indian Air Force Command, experts of the aircraft-building industry. The Russian assets were highly commended by the Indian side that is now trying to identify best approaches to training Air Force pilots operating Su-30MKI fighters, efficient employment of the expensive aircraft being

Ministry for building a pilot batch of four trainers of the type powered by AI-222 engines, their thrust mounting up to 2.5t. The first mass-produced Yak-130 is to make its maiden flight in November 2003. In the course of its trails the Yak-130 demonstrator aircraft made 485 flights proving its declared flight performance. The results of the tests have enabled Rosoboronexport to officially offer the aircraft for sale to the Indian side and submit the trainer's specifications to experts of the Indian Air Force.

Despite special status of the Yak-130, civilian-use assets are not neglected by the company, either. The enterprise is currently conducting extensive research and development on the Yak-48 regional liner, as well as building the Yak-152 basic trainer. The Yak-54 training aircraft having been recently certified, the company is now engaged in the RRJ project. Apart from this, the firm is participating in the development of the Russian fifth-generation aircraft.

All the assets represented by the Irkut Corporation were accommodated at one stand. Irkut President Alexei Fyodorov said that performance of the Indian Su-30MKIs was the best proof of the corporation's success in the past six years. Experts of the company are now implementing a license production programme, its ultimate objective being manufacture of 140 Su-30MKI aircraft by HAL. Technical data for the wing and empennage has already been handed over to the Indian side, other documents to be dispatched in the near future. A contract for delivering rigging equipment signed, the first aircraft assembled in India is to take to the air in 2004.

The initial stage of the license production agreement provides for delivering to the Indian side ready-made components; the elements provided in subsequent batches are to be less sophisticated. In the end, Russia is to deliver only raw materials and primary components, so

HAL President Mokhanti and Irkut President Alexei Fyodorov signing a pre-contract agreement.



all the aircraft will be assembled in India. The project concerns not only the airframe, but the aircraft's engines and avionics as well. The first fighter produced by the Indian manufacturers will make its maiden flight in 2007.

In the course of the Aero India 2003 air show the Irkut corporation signed a pre-contract agreement with the HAL company for producing some components of Su-30MKI fighters, including manufacture of fins, stabilisers and canards. Fyodorov added that the project in its essence envisaged transfer of some of the company's undertakings on the HAL enterprise, which is cru-

anti-aircraft assets that has been unjustly neglected till recently. According to Belyaninov, Russian companies have something to offer in this regard, and they are going to adopt a most aggressive approach. For instance, visitors to the Bangalore exhibition were attracted by the upgraded Igla-S MANPADS that had never been displayed in the country before. The weapon was devel-



Test pilot of RAC MiG Pavel Vlasov showing a MiG-29M2 fighter to Air Force Vice-Marshal Desai, Indian Air Force.



MiG-29M2 multirole fighter taking off for another demonstration flight from Yelahanka airbase

cial for the Russian corporation in promoting other prospective programmes, specifically, the MTA project and other ventures. India, for its part, has gained another partner abroad, and it is a Russian company, which makes the agreement even more significant. The contract, among other things, will cause further improvement in mutual cooperation between the two countries, which is much more important than its financial value.

Irkut has teamed up with Ilyushin and HAL to launch development of the MTA medium transport aircraft, a design project of the airlifter to be submitted to the customer in the near future.

The Zvezda-Strela State Scientific and Production Centre represented at the exhibition Kh-31 and Kh-35 air-to-surface missiles. Zvezda-Strela Designer General Sergei Yakovlev referred to India as the company's major export partner, adding that volume of missiles' deliveries to the country has grown greatly in recent years. Variety of the products has grown considerably, too. Yakovlev said that the principal task facing the enterprise now was to achieve the \$0.5 billion level of export sales in 2005, which seems to be an attainable objective.

Missile assets were displayed by other Russian producers as well. Rosoboronexport Director General Andrei Belyaninov said that Russia intended to re-enter the Indian market of

oped by the Kolomna-based Machine-building Design Bureau.

Assets of the company, specifically, Strela-2M and Igla air defence systems, are not a revelation to the Indian military; the new thing is that the bureau now offers to its customers a substantially upgraded version of the universally-known Igla-S, S standing for Super. The asset has been recently fielded with the Russian Armed Forces and is now entering the world arms market. Chief Designer of the Kolomna-based Design Bureau Nikolai Gushchin said that combat range of the modernised Igla had been increased from 5.2 to 6km, yet the principal advantage of the new asset over its baseline version is that, apart from

fixed- and rotary-wing aircraft, it is capable of engaging low-signature cruise missile-type targets and UAVs. The ability has been attained through employment of proximity fuses and upgraded warheads, which enables the missile to hit airborne targets directly or in their proximity. The two-channel heat seeker ensures reliable engagement of targets even if the enemy employs flares. Hit probability of the upgraded system has been enhanced from 0.45 to 0.8-0.9.

Apart from Igla-type MANPADS, the Kolomna bureau exhibited its new Ataka anti-tank systems fully interchangeable with Shturm assets that had been delivered earlier and are now mounted on Indian Mi-35 helicopters.

MiG-29 fighters are now in service with three IAF squadrons





BrahMos Russo-Indian anti-ship missile now under tests in India



Saras business aircraft, a local result of ex-international Russo-Indian programme

Shturms' replacement with Ataka assets will substantially increase combat capabilities of the aircraft. Gushchin expressed his firm belief that the Ataka system could be fitted on new Indian helicopters as well.

Talking of the outlook for promoting Russian-made air defence assets on the Indian market, Rosoboronexport Director General Andrei Belyaninov said that, apart from Igla-S systems, chances were fairly good for Tor-type medium-range and S-300V strategic SAM systems.

Ukrainian aircraft-building companies displayed at the Aero India 2003 exhibition an An-74TK-200 aircraft, models of future An-series passenger planes and aircraft engines. Belarus had a stand of its own, too. The assets for the exposition were submitted by the 558th Aircraft Repair Plant well known in many countries all over the world due to its sophisticated repair programme for MiG-29 and Su-27 fighters.

DEMILITARISATION TREND

Shortly before the opening of the exhibition Indian experts completed manufacture of the first prototype of the 14-seat Saras aircraft. The plane features an unconventional design of the power plant providing for employment of pusher rather than tractor propellers. The Saras project launched several years ago was originally a joint Russo-Indian programme. The Russian side was represented by the Myasishchev Design Bureau that proposed to use the Russian-made Duet aircraft for development and subsequent production of a new asset. However later, much due to the notorious bureaucracy of Russian officials, Duet and Saras began separate lives of their own. The result is that while the first aircraft is still a project, the second plane is to make its first flight in the near future, which in itself is a good advertisement of India's aircraft-building industry. The multirole asset can be efficiently used as a commuter

plane, a business jet, and a flying hospital. The Indian Air Force has already placed an order for six aircraft to be used for transportation of IAF Command officers.

In this regard a special mention should be made of the fact that Indian aviation experts show equal interest to both military and civil-purpose assets. Competition between Boeing and Airbus is still under way, the ultimate prize being the \$2.1 billion contract for providing 43 new passenger planes to Indian Airlines. Airbus is now ready to offer the Indian side an offset variant, its cost mounting up to \$500 million.

Taking a question from journalists whether he expected an aircraft production boom in India, Director of the National Institute for Advanced Studies Roddam Narasimha said that in two years' time passenger planes rather than military assets will be the highlight of Aero India 2005.

**Andrei FOMIN,
Nikolai VALUYEV**

Su-30MKI in front of the static display of Aero India 2003





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RUSSIANS IN MEXICO



For decades Mexico has been a reliable importer of US arms and military hardware. Yet the trend has changed in recent years. Today the country operates the third largest fleet of Russian-made assets in Latin America. The shift of preferences has been caused partly by the United States' unwillingness to provide its southern neighbour with cutting-edge systems, and, to a certain extent, by outstanding capabilities and relatively low cost of Russian weapons.

Mexico is the only Latin American nation bordering on the United States; for many years the two countries have enjoyed good relations – no wonder most of the hardware procured by Mexico came from the northern neighbour. Apart from several modern aircraft, among them Sikorsky UH-60 Blackhawk helicopters, the deliveries included 73 obsolete Bell UH-1Hs; the technical status of these assets made their employment impossible, so in the end they had to be shipped back to the supplier.

Currently Mexico is the fourth largest operator of Russian-made hardware after Cuba, Peru and Nicaragua; the country employs the fourth largest fleet of aircraft procured directly from Russia. The fact testifies to the high quality and

superb cost competitiveness of Russian aircraft, which is especially important for nations with restricted military budgets. Mexico's shift towards Russian products was brought about by an urgent need for new weapons to suppress the guerrilla movement plaguing the country.

In 1994 the Zapatista National Liberation Front occupied several localities in the southern part of the Chiapas state. A guerrilla war began, and the national armed forces took up the challenge. To effectively suppress the rebels, the Air Force and Navy aviation had to have their aircraft fleet upgraded and renewed. A special emphasis was put on procurement of helicopters, airlifters and direct air support aircraft. The Mexican Navy was the first to get new assets; in mid-1994 the country bought eight used Mi-8MTV-1 (Mi-17-1V) helicopters of Russian produce. It was the first Russian hardware Mexico ever procured.

RUSSIAN AIRCRAFT IN SERVICE WITH THE MEXICAN NAVY

Soon after their delivery Mi-8 helicopters entered service with the Mexican Navy aviation and saw combat in the Chiapas state providing air support to ground units of the governmental forces. Taking into consideration the elongated

shape of the Mexican territory, one might fully understand the importance of the assets used to airlift cargoes and personnel. Great operational efficiency of Mi-8 helicopters led the Mexicans to buy another 14 aircraft of the type for the Navy; the overall number mounts up to 24 helicopters, including two Mi-17-1V and 22 Mi-8MTV-1s, two of them lost in flight accidents. In 2002, apart from four Mi-17s, Mexico procured four Mi-2 aircraft that have been license-produced in Poland since the 1960s. In the late 1990s, in parallel with helicopter deliveries, the country bought from CIS nations six An-32V medium cargo aircraft that were added to the fleet of Spanish-produced Aviocar CASA C-212-200s to become the most efficient asset of the Mexican Navy aviation. Apart from their principal mission, i.e. airlifting troops and cargoes, the An-32 aircraft are efficiently employed for patrolling waters of the Gulf of Mexico and Pacific Ocean in order to counter smuggling and drug trafficking. One of the aircraft was fitted with a search radar on the outer fairing specifically for the purpose.

Mi-2 helicopters are used for light cargo transportation; for instance, they provide airlifting capabilities to Army special units comprising up to five soldiers. They are also employed as patrol and training assets. Mi-8s are used for patrolling missions as well. The helicopters of the type together with the An-series aircraft were extensively used in emergency operations providing relief to people in the course of man-caused and natural disasters, such as the Pauline hurricane in 1997, Isis in 1998, and Isidor in 2002.

Now the Mexican Navy command intend to enhance the fleet of Mi-8 and Mi-17 helicopters, as well as to upgrade in-service aircraft of the type to NATO standards through fitting them with advanced radars and night-vision devices.

One of the four An-32V cargo aircraft in service with the Mexican Air Force. Another six aircraft of the type are employed by the Navy

Mexican Air Force operates the world's largest Mi-26 transport helicopter



The most ambitious plan of the Mexican Armed Forces in regard to Russian rotary-wing aircraft envisages procurement of six Mi-24 gunships. The delivery of the helicopters intended for the Special Operations Team has been slated for 2004–2007. The assets will be used to enhance fire power of the Navy aviation that now lacks efficient strike systems. Apart from Mi-24s, eight Albatros Aero L-39 trainers are to be procured. Built in the Czech Republic, the aircraft are powered by engines of Soviet design.

Mi-8 and Mi-17 helicopters are now in service with the 1st and 5th Cargo and Patrol Squadrons that, among other assets, operate MD-902 and Bo-105 aircraft. An-32 airlifters, along with CASA C-212, one Buffalo DHC-5 and Rockwell Turbo Commander, are employed by the 1st, 2nd and 3rd patrol squadrons; Mi-8 helicopters, as well as Beech Bonanza light aircraft, are in service with the 1st Search and Rescue Squadron.

RUSSIAN ASSETS IN SERVICE WITH MEXICO'S AIR FORCE

Operational efficiency of Mi-8 helicopters in service with the Navy aviation influenced the Air



Light Mi-2 helicopters of Russian design are used by the Mexican Navy for patrol missions along the shoreline

Force command to procure a batch of 12 Mi-8T aircraft in 1996. The assets entered the inventory of the 303rd Air Squadron of the 3rd Air Force Group based at Santa Lucia Air Base. Another 24 Mi-17 helicopters were dispatched to the base in 2000.

On 15 August 2000, Mexican President Ernesto Zedillo was shown four An-32V airlifters fielded with the 302nd Air Squadron of the 3rd Air Force Group not long before that. Later a Mi-2 light helicopter and two used _i-26 heavy cargo helicopters entered the inventory of the group. The rotary-wing aircraft were bought for \$4.5 million each and are now, along with Peru's three Mi-26s, the largest helicopters in Latin America. Unfortunately, one of the aircraft was destroyed in an air crash in late 2001, so now the command are considering the possibility of procuring another aircraft instead of the lost one. Mi-26s are used by the Mexican Air Force for airlifting heavy cargoes and extinguishing fires with large-capacity overflow vessels.

In addition to it, helicopters of Russian design are operated by the Rapid Response Aviation of the Mexican Emergency Ministry. The

aircraft based at Santa Lucia Air Base are used to provide relief in the wake of hurricanes, earthquakes and other natural disasters. As many as four echelons of airborne assets are activated in case of emergency. The first echelon is made up with five MDD530F and five Cessna 182S aircraft employed to reconnoitre disaster areas; Blackhawk helicopters are assigned transportation missions. The second echelon comprises six



In 2004 it will be ten years since Russian-made Mi-8MTV-1 (Mi-17-1V) helicopters have been in service with the Mexican Navy

Mi-8s employed to provide people with medical aid and medications, as well as to evacuate them from affected areas. The assets of the echelon are capable of delivering relief to three districts within three days, aiding some 1,500 people with medicine, medical aid and food products. The third echelon is assigned the task of airlifting cargoes and recovery equipment via Mi-26T helicopters. The assets of the fourth echelon, i.e. An-32 airlifters, are used to ensure uninterrupted air communications with the affected area within prolonged periods of time. Upon completion of their missions all the aircraft are to return to their home bases.

The system in question was first put into action in the wake of the hurricanes and earthquakes that occurred in January and February 2001 in Salvador. Following the disasters, servicemen of the Mexican Armed Forces operating Mi-8 helicopters and An-32 fixed-wing aircraft launched a relief operation aimed at aiding the local population.

Mi-8 and Mi-17 helicopters are, among other things, extensively used in countering drug trafficking. Special task forces made up with fixed- and rotary-wing assets of various squadrons are allocated for the purpose. Reporting to the Land Forces Command, they provide air support to Army units that have no aviation assets of their own. Above all, the aircraft are used for patrol missions along the US border where drug trafficking is the most intense.

POLICE AIRCRAFT

The PFP Mexican Federal Police is another agency operating Russian-made aircraft. In 2000 the police procured four Mi-17 helicopters, their

principal mission being airlifting troops and cargoes in the course of anti-criminal and, primarily, anti-drug trafficking operations. The aircraft with camouflage paint can be employed as combat assets, since the complement of their equipment is similar to that of the assets in service with the Air Force and Navy aviation. These, in fact, are the only camouflaged helicopters of the whole fleet of Mexico's rotary-wing aircraft. They

are used for landing special forces units, as well as for liaison and reconnaissance missions. Apart from that, the helicopters can be efficiently employed in the course of relief operations.

AVIABALTICA IN MEXICO

With support of the Mexican Navy aviation command the Russian Aviabaltika company intended to build a plant in the locality of Campeche; the facilities were to be employed for assembling, repairing and servicing Mi-8 and Mi-17 helicopters operated by the Navy aviation, Air Force and police in Mexico and other countries of the region. So far, the project has not gone beyond the stage of assessment and negotiations. After all relative questions have been agreed upon, Aviabaltika can be the first Russian enterprise to assemble aircraft on American soil.

Juan Carlos Cicales, Santiago Rivas, Argentina exclusively for Air Fleet

Aircraft of Russian design in service with the Mexican Armed Forces		
	Delivered	Operational as of 2003
Navy Aviation		
Mi-8MTV-1	22	20
Mi-17-1V	2	2
Mi-2	4	4
An-32V	6	6
Air Force		
Mi-2	1	1
Mi-8T	12	11
Mi-17	24	24
Mi-26T	2	1
An-32V	4	4
Federal Police		
Mi-17	4	4



RUSSIA'S ROTARY-WING GIANTS

ON EVOLUTION OF RUSSIAN HEAVY HELICOPTERS

The Russian-made Mi-26 is the world's largest rotary-wing aircraft employed, its lifting capacities being unequalled, too. The aircraft is widely used for airlifting heavy cargoes in Russia, CIS states and internationally. For several years Mi-26s have been successfully employed in the two Latin American countries – Peru and Mexico. The creation of the Mi-26 is a natural success of Russia's heavy helicopter engineering. Over 50 years Russia has been steadily leading the world in the development of heavy helicopters, the numerous world aviation records attributed to this country being solid testimony to the fact. Professor Vadim Mikheyev, a renowned aviation historian, speaks of the evolution of this particular branch of aviation engineering in his essay below.

Russian designers of rotary-wing aircraft have always given special priority to the development of helicopters with high lifting capacities, which has not been so much dictated by Russian engineers' consciousness of giant size as the unique geographical position of this country and its climatic conditions. Certain parts of Russia have always remained wild and undeveloped, which has created a strong demand for heavy-lifting aircraft with vertical take-off and landing capabilities, the latter two being of utter importance as aircraft featuring such characteristics don't require construction of expensive runways. Heavy-lifters have always been popular with both civil and military customers.

A series of helicopter prototypes with relatively high lifting capabilities were developed as far back as before the revolution of 1917. During World War I Georgy De Bothezat, a prominent Russian scientist, made an attempt to build a heavy helicopter with four rotors for the Russian Army. Unfortunately, the Bolshevik revolution left the scientist's undertaking unaccomplished. Eventually he did manage to complete the project but only after he had immigrated to the USA. The helicopter with the take-off weight of 2t remained unrivalled almost until the very beginning of World War II.

The state did not take the development of helicopters seriously until after the revolution of 1917. It was in 1926 that a team of helicopter engineers organised within the department of aerodynamics investigations and led by the renowned Soviet scientist Boris Yuryev started their research work in alma mater of the Soviet aviation – Central Aerohydrodynamic Institute (TsAGI). The team of researchers was led by a talented engineer Alexei Cheryomukhin. Having made some preliminary estimates by early 1927 the team designed three prototypes of the following configurations: single-rotor, side-by-side and multi-rotor. The first and second prototypes were light single-seaters, whereas the third one, a multi-rotor helicopter, was designed as a heavy assault aircraft supposed to carry as many as a squad of Red Army soldiers.

Yuryev considered the multi-rotor aircraft the most promising one of the three developed.

The helicopter was designated as the Yu-2 and featured eight independent engine-propeller units or 'elements', each of which consisted of the M-2 engine rated at 120hp and a two-bladed 6-m diameter rotor. It was this very configuration that Yuryev saw as the most expedient for heavy lifting helicopters. The eventually developed rotors and transmission were simple in design and relatively lightweight. Having bench-tested one 'element' (a motor, a rotor and a control system) the scientist intended to simply 'assemble' helicopters by fitting a few 'elements' together. The Yu-2's eight 'elements' were to have enabled the vehicle to operate with a take-off weight of 5t. The 'elements' were attached to the sides of the fuselage – four on each side. The fuselage proper was designed in the shape of a railway car. At mid-body of the fuselage there was a tall turret with a machine-gun mount fitted to its top to protect the upper sphere above the main rotors. This is the first Soviet helicopter as it was initially designed.

In 1928 Yuryev constructed a test bench in the yard of TsAGI in order to test joint operation of two 'elements', a step preceding his building of a full-scale prototype. However, after Yuryev had resigned from the Institute the team, deprived of their mainstay, had to limit the scope of their work and ended up with a single-rotor helicopter. The Yu-2 project was never implemented. It was only during World War II that Academician Yuryev managed to resume design-

Top page: the heaviest and the largest helicopter of all times: the Russian V-12 rotary-wing aircraft designed by Mikhail Mil, 1967. The take-off weight of the helicopter exceeded 100t, cargo lifting capacity mounting to 40t on record flights!

ing the prototypes of heavy multi-rotor assault helicopters, with most of the development work taking place in the Zhukovsky Defence School of Aviation Engineering. However, these projects failed, too.

Another attempt of the Soviets to design a relatively large helicopter was taken in the mid-1930s in the Research Institute of Civil Air Fleet. It was at that time that Vittorio Isacco arrived in Russia on the advice of Comintern to take over the project. The designer was to develop the so-called Velner single-rotor configuration with the main rotor driven by engine-propeller units fixed at blades' ends. Helicopters of this type, dubbed 'helicogyros', had been constructed by Isacco in England and France before, but proved unsuccessful. Nevertheless, the Comintern's protégé did enjoy universal support in the USSR.

The Soviet-made Isacco helicogyro was built with grandeur that well reflected the spirit of the 'socialist competition' typical of the Soviet era. Isacco-4's design take-off weight exceeded 3.5t which was not the case with earlier prototypes, their take-off weight mounting up to only one ton. Its four-bladed rotor was 24.4m in diameter, which was a real breakthrough. At the end of each blade there was an engine-propeller unit powered by Gypsy III engines rated at 120hp. Another engine, the Wright J-6 rated at 300hp, was fitted to the nose part of the fuselage to drive the tractor propeller. The rotorcraft was designed as a passenger helicopter capable of taking six people aboard.

Test flights of Isacco-4 were carried out from 1935 to 1937. Great centrifugal and deflective forces warped the blades and broke off the motors mounted on them, vibrations and aero-elasticity phenomena accompanying the tests. The tractor rotor of the helicogyro never reached the rated rotation frequency. In the end, the funding of the project was suspended, Isacco expelled from the country and his team-mates of the Russian origin were subject to repression, common practice in those times.

In between the two world wars all Soviet-made rotary-wing aircraft tended to be relatively big in size. All the helicopters and gyroplanes built in the State Aviation Institute surpassed their foreign analogues in dimensions and weight. The tendency was not the product of ambitions harboured by Soviet designers but a common tradition to fund certain experimental designs which boded well for the creation of hardware that could be practically employed in the Red Army units. Therefore all Soviet-made helicopters and gyroplanes were equipped with the best equipment, the most powerful engines and armament justly comparable to those of the combat aircraft. Test flights and engineering follow-up required a lot more to be done. Most of the projects failed, with the repres-

sions of 1937-1938 putting a near end to the development of rotorcraft.

OKB-3, an experimental design bureau led by Ivan Bratukhin, resumed designing the helicopter prototypes in the USSR in the early 1940s. Throughout the war this newly organised team of specialists managed to design the Omega II side-by-side rotor helicopter with a take-off weight of 2.3t, which appeared to be comparatively good. The asset was followed by slightly modified G-3 and G-4 aircraft that were put into limited production and operation. The administration of the Soviet aviation industry overestimated the attained success and entrusted the OKB-3 design bureau with the development of the B-7 heavy transport helicopter.

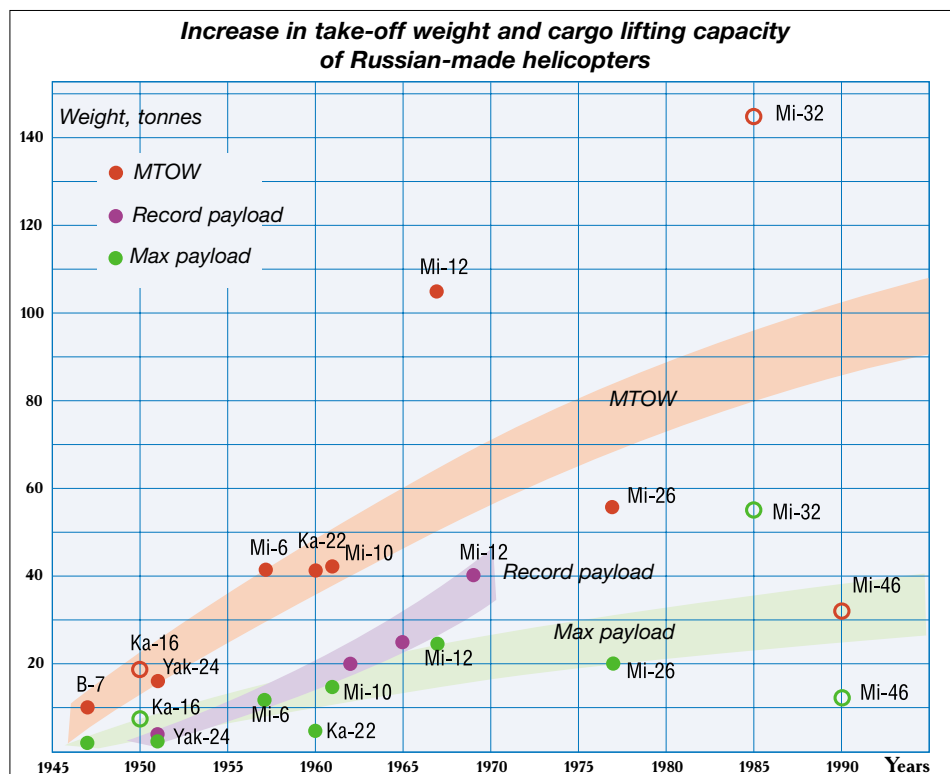
In terms of dimensions and weight, the B-7 was designed to surpass both the existing rotary-wing aircraft and those under development. Both of the rotors placed side by side were 16m in diameter, the vehicle's total length equalling 19.65m with a width of 32.4m. Maximum design take-off weight mounted up to 10t. Each nacelle of the B-7 was to accommodate one ASh-82FN engine. The spacious cargo hold could seat up to a platoon of paratroopers or house 2,000kg of cargo. A standard load was one of various types of artillery guns and one GAZ-67 jeep. Wheeled vehicles were to be loaded into the cargo hold through a wide tail cargo hatch. To provide for an easy access to the hatch, the tail was designed as a raised monocoque beam with a twin tail unit. The statement of work provisioned that the helicopter with a crew of three on board and 2,000kg of cargo be capable of flying at a speed of up to 225km/h,

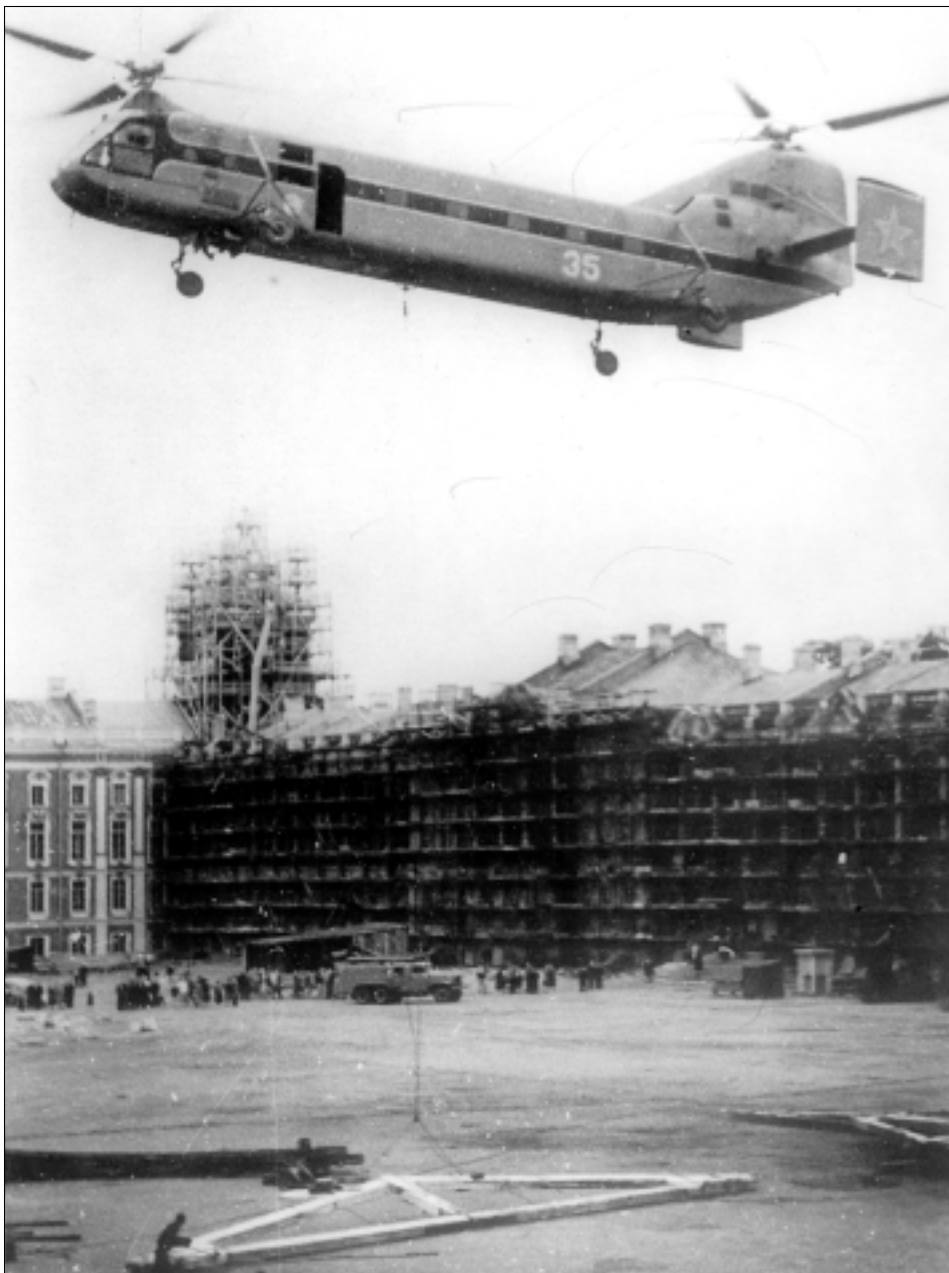
climbing up to 5,000m and being airborne for up to two hours.

The experts of OKB-3 had finalised the draft of the B-7 by 1947 and went on to design it, but a resolution issued by the Council of Ministers on 12 December 1947 ordered that OKB-3 focus on the improvement of already-built Bratukhin helicopters. The primary reason behind the order was numerous problems previously unknown of that had arisen in the course of ground and flight tests. Typical of the side-by-side-configuration helicopters, the problems primarily consisted in the necessity for accomplishing the task of ensuring proper dynamic strength of the helicopter, the process requiring long-term and expensive experimental tests and analytic research.

The experimental testing of the nacelle attachment consoles for their stiffness characteristics constituted the bulk of the research work done by the experts of OKB-3. Special test benches were set up to conduct full-scale testing of outer wings. The ground test bench was used to adjust the stiffness characteristics of the wing together with the nacelle and landing gear. The tests enabled the experts to determine the basic stiffness characteristics of the wing and nacelle as well as other components under bending and torsional stresses. The experiments were accompanied by OKB's engineers developing the first theoretic techniques which helped analyse the phenomena of dynamic instability of helicopters' outer wing structure.

Such fundamental research work in the field of aeroelasticity and dynamics of helicopters' structure with side-by-side configuration had never been done before. The designers





Yak-24 helicopter, also referred to as the Flying Wagon, boasted the largest lifting capacity in the USSR in the 1950s before the Mi-6 advent

managed to solve a number of most complicated problems. However, the final stage of development of the Bratukhin helicopter dragged on for too long with plans ruined and deadlines broken. The administration of the Soviet aviation industry considered the side-by-side configuration unpromising. Thus, in May 1951 the first experimental design bureau in Russian history, led by Bratukhin, ceased to exist.

A mention should be made of the fact that I.P. Bratukhin did not consider the B-7's characteristics a maximum that could ever be achieved. He had been involved in the development of heavier aircraft featuring twin-rotor and multi-rotor configurations and having a lifting capacity of over 5t. However, the two projects did not get the proper backing.

Upon liquidation of the design bureau led by Bratukhin, the ownership of all the produc-

tion facilities and premises owned by the bureau, which were located in the first Russian specialised helicopter-building plant in Moscow's Sokolniki District, was transferred to the design bureau headed by Nikolai Kamov. The designer adhered to the concept of creating the then popular twin-rotor tandem configuration helicopters featuring high lifting capacities. By the late 1940s Kamov had prepared drafts of such helicopters which he submitted to the administration of the aviation industry. Those were the Ka-13, the Ka-14-1 and the Ka-14-2 with take-off weight of 6.5, 8.5 and 16t respectively. The largest of them was to be equipped with two powerful ASh-82FNGR engines, each of which drove a 25-m diameter rotor. Engine-propeller systems were synchronised by a shaft. In other words, Kamov suggested building a helicopter whose characteris-

tics were similar to the Piasecki YH-16's, which featured the same aerodynamic configuration. In those years the Piasecki YH-16 was being developed in the USA.

However, the undertakings of the Soviet designer were supported neither by the administration of the aviation industry nor by the military who thought that funding such a project was risky. As for Kamov, he was feeling doubtful about the project, too, thinking that constructing main rotors of such great diameter might have proved impracticable. Instead, he got down to developing the new Ka-16 project. The power plant and fuselage aerodynamic configuration remained unchanged, similar to those of the Ka-14-1, but the number of rotors mounted up to four, their diameter not exceeding 20m. Design take-off weight equalled to 18.6t with payload weight of 7.2t. The giant-sized helicopter was fairly named Ivan the Terrible, a move which still did not solve the problem of funding. Military commanders and national economy administration did not properly realise the need for rotary-wing aircraft.

However, the situation changed during the war in Korea. The effective employment of helicopters by the Americans made Soviet leaders realise that helicopter-building was one of the key industries serving national interests. It was at the historic meeting which took place in September 1951 that Joseph Stalin ordered the Soviet aviation designers to develop new transport airborne helicopters of high lifting capacity as soon as possible. The designers were given as little time as one year to accomplish the task. Kamov knew it only too well how the totalitarian regime treated those who broke the deadlines in development of military hardware which led him to refuse to build Ivan the Terrible within the set time limits. As a result he was deprived of the well-equipped plant in Sokolniki. Another design bureau led by Mikhail Mil "moved into" the plant. Mil got down to developing an assault transport helicopter with a take-off weight of 7.5t, which was to become the Mi-4. Mil claimed he could meet the required deadline of one year. As for the Bratukhin B-7 and Kamov Ka-14-2 helicopters, the task of their development was entrusted with the renowned designer of fighters and sports airplanes Alexander Yakovlev.

The heavy tandem-rotor Yak-24 helicopter took one year to build. July 1952 saw the helicopter take off for the first time. Yakovlev managed to keep the set deadlines mainly because he had been given the already-worked-out drawings of the dynamic system (the power plant, the rotor, the transmission and the control system) of the Mi-4 by its designer. In truth, the Yak-24 was assembled of the Mi-4's two engine-propeller systems joined together by the airborne Yak-14's fuselage. The same methods of 'doubling' an aircraft's lifting capacity were developed by many helicopter



Mi-6 became the most numerous of the Russian heavy helicopters. Despite the great variety of different versions, the aircraft was originally developed as part of the so-called helicopter missile platform. Photo on the right: Loading the 9P114 launching unit with a Luna-MV tactical missile into the Mi-6RVK cargo hold (9K53 missile helicopter platform)

designers outside the USSR. The Yak-24's peculiar appearance was well reflected in its name – Flying wagon.

In 1954 the Yak-24 was put to mass-production at Leningrad's plant No 272. In 1955 the helicopter set a number of records, one of which consisted in the lifting of 4t-heavy cargo. It was the first time that a Soviet rotary-wing aircraft had become the most heavy-lifting machine in the world. The Sikorsky S-56, a helicopter featuring the same lifting capacities, was built a few years later. The Piasecki YH-16 mentioned above was never put to production. There were a number of Yak-24 modifications: a presidential version, a pipe-laying variant, a tanker, a film studio version, a passenger version (Yak-24A). However, the modifications were not put to operation. Of the 40 helicopters built only 15 models were practically employed.

In the course of ground and flight tests Yakovlev faced numerous intractable problems typical of tandem-rotor helicopters. The problems were compounded by large dimensions of the aircraft. The most difficult problem was vibrations occurring in flight, whose extent could, in some modes, threaten the structural integrity. To reduce the level of vibrations the designer had to increase stiffness characteristics of the fuselage, construct shorter blades and change the gearing of the control system. As the development went on, the weight of the aircraft increased. Though the tests of the Yak-24 were suspended thrice they were over only in April of 1955.

In 1957 the Leningrad-based branch of the OKB led by Yakovlev built a modernised basic

version of the Yak-24U (U standing for widened). The wider fuselage of the helicopter improved its transportation capabilities and vibration characteristics. However, the same year saw the first take-off of a new helicopter designed by Mil, which positively overshadowed Yakovlev's Yak-24. Being well aware of the labour-intensiveness required to develop rotary-wing vehicles, Yakovlev lost any interest in further development of the project. A bold attempt made by Igor Erlikh, the head of the Leningrad-based branch, to declare himself independent of the Moscow-based OKB boded ill for the future of the Yakovlev helicopters, too. Yakovlev was not a man to forgive such a move. The draft of the Yak-32 designed by Erlikh (a modified version of Mi-6 which featured a twice as high lifting capacity achieved through joining together the two of its engine-propeller systems by a long fuselage) was never implemented. The Yakovlev OKB ceased to develop helicopters in the early 1960s.

Unlike the Yak-24, developed directly after the aforementioned meeting in the Kremlin, the Mi-4 turned out to be a perfect success. In process of its tests and operational development Mil's Design Bureau learnt to overcome the most difficult, helicopter inherent problems. The authority of the design team improved. As a result, the government backed the project of a new heavy helicopter of huge unrivalled dimensions and cargo lifting capacity of up to 12t and in June 1957 the vehicle named Mi-6 made its maiden flight. During the development the designers faced a number of



extremely hard tasks and primarily the task of constructing a giant main rotor with diameter of 35m, transmission and several assembly units unique for the time being. The Mi-6 went to production in 1959 simultaneously at two plants: No 23 in Moscow and No 168 in Rostov-on-Don. As many as 50 aircraft were built in Moscow and 874 in Rostov-on-Don.

The Mi-6 was widely used both for civil and military purposes both in Russia and in more than a dozen foreign countries. The Mil Design Bureau created the following modifications of the Mi-6 basic version: cargo-passenger, passenger, oil field survey, search and rescue, fire-fighting, EW, radio-relay, tanker, airborne command post, ASW, mine sweeping tug, numerous airborne labs and most important – missile-carrying platforms. The main incentive for heavy-lift helicopter programs financing in the Soviet Union has always been the provision of mobility for the Rocket Forces. The Mi-6 was capable of carrying tactical and theatre missiles together with launchers and separate parts of strategic missiles as well.

The Mi-6 created a furore in the world of helicopter producers.

"The new Russian giant Mi-6 is capable of lifting the biggest fully-loaded Western helicopter" – a US media quotation of those times. Since creation of the Mi-6 in 1957, Russia has firmly kept the world lead in the development of the biggest and most advanced in load carrying capacity helicopters. The Mi-6 lifted 20t of cargo in 1962 and its record take-off weight amounted to 48t in comparison to 34t, the best achievement of foreign helicopters.

In 1960 Mil's Design Bureau implemented the Mi-6 dynamics layout for creating a unique helicopter – the Mi-10 flying crane designed to carry large-size cargoes on the outer sling and it differed from the Mi-6 by its fuselage and landing gear. The high landing gear allowed to house under the helicopter fuselage not only missile systems but loads of any type and size including various types of containers. There was no spacious cargo cabin and thus the



Mi-10 specialised helicopter carrying cargoes on a rigid external sling was primarily used by the Soviet Armed Forces, weight of the cargo mounting up to 15t& Top: Mi-10K flying crane

fuselage became much simpler and the weight of the Mi-10 exceeded that of the Mi-6 by three tons only with a maximum payload of 15t. The Mi-10R modified version in 1965 set an absolute world record in load lifting that amounted to 25t. The so called 'short-legged' Mi-10K modification made its maiden flight the same year and was widely used for derrick operations in Russia, being a proper proof that the helicopter could make not only a unique combat transport means but also an indispensable technological asset. Mi-10K flying cranes are still in operational use. The overall number of Mi-10s and Mi-10Ks produced by the Rostov-on-Don manufacturer is 40.

A simultaneous endeavour to create a rotorcraft with a high load carrying capacity was taken by Kamov. His vehicle named the Ka-22 rotorcraft was designed following the popular for those years layout of a 'hybrid' aircraft which apart from helicopter-type main rotor

employed wings and tractor airscrews, typical of fixed-wing aircraft. In horizontal flight when the speed increased the loads were removed from the main rotors and at high speeds 80-90 per cent of lift was created by the wing, whereas almost all the propulsive force – by airscrews. This sort of layout was to provide higher than ordinary flight speed and distance for the helicopter and to increase the operational life of the flight structure. The military customer wanted a comprehensive employment in a unified transportation system of three types of aircraft designed to carry approximately the same type of cargoes: the An-12 aircraft, the Mi-6 helicopter and the Ka-22 rotorcraft.

Trying to avoid certain difficulties in designing a large-diameter main rotor, Kamov decided again to implement a double-rotor layout for his heavy lifter, however, this time he positioned rotors not in tandem but side by

side. This kind of layout, as deemed by the designer, was "to organically combine the fixed- and rotary-wing aircraft, thus providing for compact power plants". Every engine nacelle mounted on the wing tips was equipped with one turbofan engine. Taking into account the Bratukhin Design Bureau's experience in handling the issues of design dynamics, Kamov created a quite rigid wing with large area. The direction of the main rotors rotation differed from other Russian-built helicopters of similar design, too – its outer blades moved over the fuselage.

Unfortunately the Ka-22 construction and operational development took it until 1959 when its maiden flight was carried out. A lot had to be additionally done in order to improve the rotorcraft flight capabilities, to decrease vibration, to adjust the blades and other structural elements. In process of flight tests the rotorcraft managed to set a number of records including the one for the helicopter top speed – 356km/h. In 1962 Tashkent Plant No 84 built three more Ka-22 prototypes. However, two crashes doomed the Ka-22. Since the catastrophe causes were never properly established, the Air Force leaders, who had by then lost confidence in the vehicle of an unusual type, gave no chance for Kamov's Design Bureau to take their machine to the operational development stage.

Ka-22M's operational development was terminated in 1964. Numerous other projects of the rotorcraft, including more cargo lift capable Ka-34 and Ka-35, failed, too. The main drawback of these aircraft was a poor thrust-to-weight ratio and big thrust losses due to downwash stream effects the main rotor had on wings. Having surpassed slightly the Mi-6 in the maximum flight speed, the Ka-22 lagged behind in load carrying capacity.

Mil, having created the biggest helicopters for the time – the Mi-6 and Mi-10, did not con-

sider the obtained load carrying capacity of 12-15t as the limits for the rotary-wing aircraft. According to his estimates, both the military and civil authorities were in need of aircraft with load carrying capacity of 20-25 and 36-40t which were the weights of typical main cargoes: the light and medium tanks and corresponding mobile missile systems as well. The task of creation of heavy-lift helicopters demanded to cope with enormous problems. The classical single-rotor vehicle layout with a mechanical drive of the main rotor required to design a powerful gear and the longitudinal centre of gravity for the vehicle as a whole. In the late 1950s Mil endeavoured to develop the V-7 prototype helicopter with a jet propulsion of the main rotor with the use of compact sized jet engines mounted on the blade tips. The layout design reviled numerous difficulties and as a result the single-rotor composition for the future super heavy lifting helicopters had to be abandoned.

In early 1960 Mil decided to build increased cargo carrying capacity helicopters employing the so-called 'modular' method that provided for the combination of several motor-propeller systems taken from the already tested vehicles. The Mi-6 motor-propeller system was taken as a module for the super heavy lifters with two modules intended for 20-25t helicopters and three modules for 36-40t ones.

The projects were dubbed the V-12 (Mi-12) and V-16 (Mi-16) accordingly. Considering all the problems faced by the designers of the helicopter tandem layout Mil opted to design the V-12 with two 'modules' placed side by side. The V-16 'triangular' layout was selected as follows: one rotor in the nose part and two side-by-side ones in the rear.

Mil's Design Bureau opted to build the V-12 first. The huge cargo bay was shaped according to the dimensions of the An-22 Antei fixed-wing aircraft since the new helicopter was to jointly operate with it while providing the mobile platform for missile systems.



Nikolai Kamov's Ka-22 rotorcraft was the first flying 'hybrid' with great lifting capacity, that, however, was never put into serial production. It set the world's 356 km/h speed record for rotary-wing aircraft

The bureau's engineers had carried out an enormous experimental and analytic work primarily while designing the main rotors attachment consoles that finally turned out to be light weight and hard providing at the same time minimized losses due to the rotor downwash stream. All the problems related to aero elasticity and design dynamics were solved at the design stage.

The V-12 made its maiden flight in June 1967. Apart from only one form of the design dynamics instability that popped up during the first flight and was soon taken care of the helicopter brought no serious problems during the tests. In process of its flight tests in 1969 the absolute record of cargo lifting capacity of 40t was set and is still unbroken. The rated maximum payload of the rotary-wing giant was 25t with a take-off weight 105t. The government of the USSR came to the decision to commence series production of the Mi-12 starting from the next year at Saratov aircraft factory No 292.

Simultaneously, an even more powerful heavy lifter, the V-16, was being shaped in the dummy work shop of the factory. It was being

developed taking into account the experience gained during the V-12 tests with the implementation of the already known double-rotor layout instead of the three-rotor one. Its power plant was intended to use super powerful gas turbine engines rated to more than 20,000hp with low-rpm free movement turbines with vertically positioned shafts and multi-blade, high-load main rotors to be mounted on top of the shafts.

Despite the unique performances, only two prototypes of the Mi-12 were made. The main reason for that was a new concept of a mobile missile-carrying platform adopted by the military, who had opted for railway missile platforms. The remaining types of cargo had no need in such an expensive carrier as a helicopter. Besides, Mil's death played a sad part in the V-12's destiny. His successor, young director of the Mil Moscow Helicopter Plant Marat Tishchenko, was yet to gain the 'weight' required in the bureaucracy environment in order to push his brainchild through as his predecessor had done. Moreover, Mil's successors feared that the Mi-12 development might affect designing a new Mi-26 helicopter seen largely an alternative to the Mi-12 built to higher technological standards. The scientific level of the early 1970s could already allow for development of such a vehicle based on considerably simpler classic single-rotor layout. The V-16 never made it past the prototype stage.

The Mi-12 designing helped the Mil helicopter plant experts create a unique systematic approach to helicopter parameters analysis and selection taking into consideration the design dynamics instability effects, thus confirming the advantages of the side-by-side layout and proving expediency of 'doubling' engine-propeller units in order to increase cargo lifting capacity of rotary-wing aircraft.

Hence, as soon as the Mi-26 new single-rotor heavy-lifter came to a stage of designing and construction, the Mil company designers

Development of the Mil V-16 super-heavy helicopter carried out as part of the V-12's improvement programme. The aircraft's average cargo lifting capacity increased up to 40-50t





Mi-26, the world's largest and most powerful production cargo helicopter, with a Mi-10 heavy helicopter underslung

started working out options to 'double' engine-propeller units or 'modules'. However, the required typical cargo lifting capacity of 45-55t (oil derricks, missile systems, main battle tanks, etc.) was not easy to achieve by merely 'doubling' the units, so engineers came up with an idea to 'triple' the Mi-26 engine-propeller units. In order to decrease the losses due to the mutual influence of the main rotors one 'module' was positioned in the nose part and the other two – in the rear part. Taking into account that most of large loads are carried underslung, the project designers decided to create the Mi-32 flying crane with a low-volume fuselage that consisted of cylinder beams interconnecting the engine-propeller units in the form of a triangle. Only by implementing such a layout the structure's own fluctuations eliminated the threat of self-inducing fluctuations of air resonance. In order to rule out the chance of blades' hitting structural elements, the designers made beams with a curve in the middle.

By the early 1980s the unique and unrivalled layout of the super heavy lift flying crane

had been finally shaped. The in-depth draft of the Mi-32 'triangle' helicopter was completed in 1982. The design take-off weight of the aircraft was 136-146t. As estimated by the Mil company engineers, by the end of the decade the unique transport-technological aircraft would have been developed to the operational condition. However, no directive on commencing its production was ever issued. The stagnation era was at its peak, so many brilliant projects sunk into oblivion.

The Mi-26 still remains the heaviest and most cargo lift capable helicopter in Russia and in the world. It has already been mentioned that its development began early in the 1970s. Extensive fundamental testing and analysis preceded its creation. The helicopter with a take-off weight of 56t and a maximum payload of 20t made its maiden flight in 1977. During the record setting flights the Mi-26 managed to lift as much as 25t of cargo. Having completed the tests, the Mi-26 has been in production at the Rostvertol company (in Rostov-on-Don) since 1980. Almost 300 helicopters have been

produced and are now being successfully used both in Russia and abroad.

Apart from the CIS countries, the Mi-26 is in service of the armed forces and air companies in India, Mexico, Malaysia, Peru, North Korea, South Korea and Greece. Besides, these helicopters are currently being employed in at least a dozen countries under lease agreements and UN contracts. A number of states are currently conducting negotiations with Rostvertol on purchasing Mi-26s. A distinctive advantage of this helicopter is its ability to carry out the derrick operations. For this purpose numerous modifications and special equipment have been worked out by both Moscow and Rostov-based helicopter producers. Unrivalled cargo lifting capacity makes the Mi-26 an extremely useful tool for fire fighting operations.

The Mi-26 baseline version has been modified into a number of other derivatives: passenger, flying hospital, geological survey lab, tanker, border patrol helicopter for arctic regions, airborne command post, etc. The Mil Moscow Helicopter Plant headed by Designer General A.G. Samusenko has developed numerous modifications and upgrade versions of this unique aircraft, aiming to expand areas of its operational use and improve its performance. In particular, a possibility has been explored to create on the basis of the Mi-26 dynamics system the Mi-26K flying crane with a modified fuselage and landing gear, as it was the case with the Mi-10K. The Mi-26M upgrade features greater cargo carrying capacity thanks to the more powerful D-127 engine. The Mi-26K and Mi-26M versions will be capable of lifting loads of up to 30t. Economical restraints of the last decade have considerably hindered the development of the projects, however, if the customer expresses interest, the programs can be implemented in the shortest terms.

The upgraded Mi-26 cockpit exhibited at the 2002 Farnborough Air Show is an indication of resumed activities at the Mil and Rostvertol plants aimed at improvement of the most cargo lift capable helicopter in the world. One has simply to replace on-board equipment, and the Mi-26 will turn into a round-the-clock aircraft operated by a reduced crew, which considerably decreases its operational costs.

Finalising the review of Russian heavy-lift helicopters, worth mentioning is the Mi-46 project with cargo lifting capacity of 10t. It was developed in the 1980s aiming to fill the gap between the Mi-38 and Mi-26 aircraft, given coming phase-out of Mi-6 and Mi-10 helicopters. A number of European operators have expressed their keen interest in procurement of such aircraft recently, while the world's biggest helicopter-building consortium Eurocopter is willing to cooperate with the Mil Moscow Helicopter Plant on the Mi-46 development program.

Vadim MIKHEYEV

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